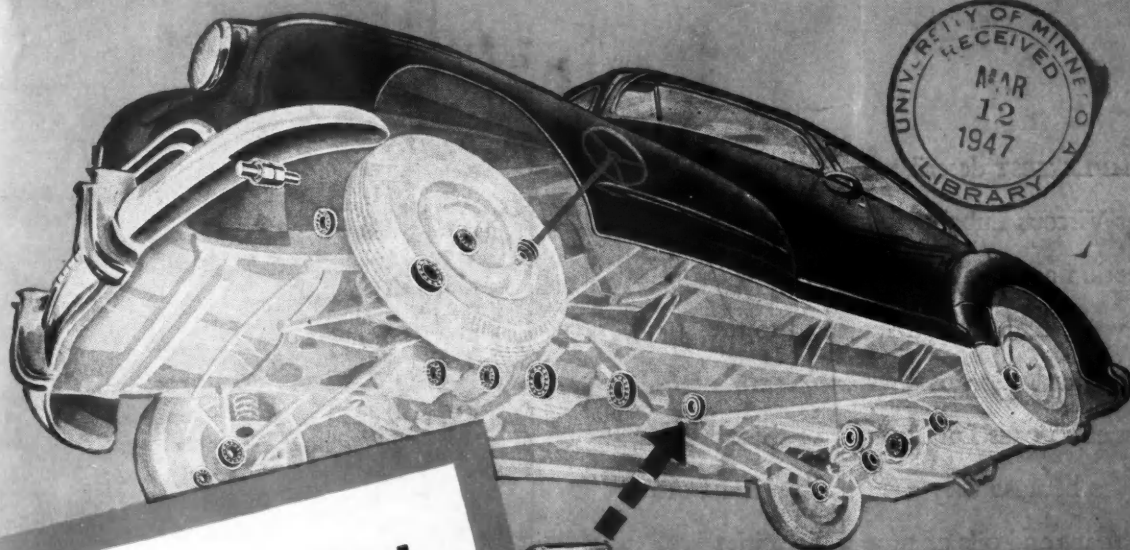


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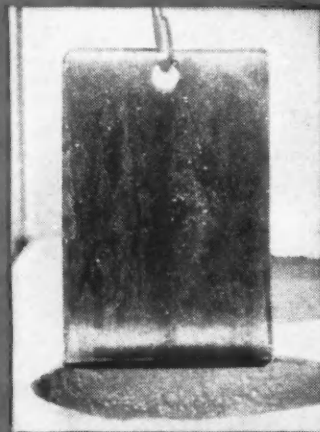
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Test equipment for comparing water resistance of greases. Metal strips are coated with greases to be compared. Left strip—a conventional type soda soap grease. Right strip—a Calumet Viscous Lubricant.

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SERVICE

AUTOMOTIVE and Aviation INDUSTRIES

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Some High Spots of this Issue

How Big Will Car and Truck Production Be in 1947?

We have here an overall survey of the many vital factors that will influence and largely determine the extent of the output of new vehicles during the coming months. George Romney of AMA points to strip and sheet steel, copper, pig iron and perhaps soda ash, in the shortness and irregularity of their supply, as possible deterrents together with the uncertainty with respect to labor's attitude but still sees a chance for 4,700,000 units during the year. See page 17.

Mass Production Tolerances in Millionths of an Inch

New precision techniques and latest automatic machine methods are extensively used in turning out fuel injectors at the ultra-modern plant of G. M. Diesel Equipment Division and maintain high level of quality in finish, tolerances and clearances of mating parts. The facts are given by Joseph Geschelin beginning on page 18.

New Pressure Duration Indicator for Multi-Cylinder Diesels

To show the equality or non-equality of load distribution among the several cylinders a new indicator, sturdy, reliable, easily mounted and operated and of moderate cost has been developed and is described together with its accomplishments by Professor DeJuhasz in a two-part article of which Part I will be found on page 22.

What's Newest in Engine Bearings

P. M. Heldt has gathered significant facts and figures and has condensed and correlated them for quick and easy reading. This article deals with materials and types, compares copper-lead, aluminum, silver and discusses micro and grid. It starts on page 28.

An Engine Assembly That Is Unique

Parts and accessory kits flow on the conveyor line with the engines for which they are intended. Assembled in the stock room the kits are placed in traveling racks arranged according to the production schedule. See page 25.

New Federal Six-Wheel Truck; 25 Items of New Parts and New Production Equipment and More High Spots

Such as: Late Slants on High Prices; Future Foreign Trade Under Reciprocal Agreements; Piston Tooling Innovations; and a bang-up article showing how aircraft engine output has been increased three-fold through design refinements.

Comprehensive Interpretation of Industry News, Page 48

For Complete Table of Contents See Page 3

**AUTOMOTIVE
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March 1, 1947

15

**SMALLER
THAN A**

Thumbnail



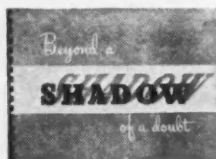
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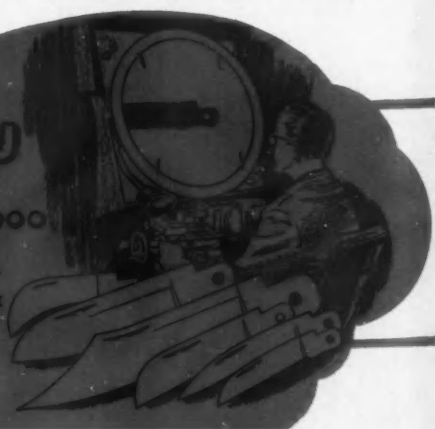
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How Many New Cars and Trucks in 1947

By George Romney

Managing Director, A.M.A.

ORDINARILY three factors would determine the answer to the question, How many cars and trucks will we get in 1947? First, market demand; Second, production efficiency, which is basically the human factor; and, Third, vehicle production capacity. However, since virtual completion of essential reconversion steps five months after the war ended, vehicle production has depended primarily on availability of a few basic raw materials and the status of labor-management relations. These will continue to be the major factors.

The most important 1947 consideration is the availability, particularly, of sheet and strip steel, copper and pig iron. Present facts indicate that from a supply standpoint vehicle manufacturers will continue on a hand-to-mouth basis throughout the year.

Sheet steel will be the material in shortest supply, with copper and pig iron continually threatening to occupy this position and probably doing so for brief periods. A dark horse, called soda ash, could retard output, and we may hear more about this animal in 1948.

That being the case, what is the outlook for sheet steel? Last year 16,000,000 tons of these flat rolled products were produced. Full production of steel was not attained, due principally to the coal and steel strikes. Barring similar catastrophes this year, output of flat rolled steel should reach 17,000,000 tons. Original steel industry plans called for attainment of a 19,000,000 ton capacity by the end of this year, but the "latest estimates as to when these planned facilities will be in and running now extend well into 1948." The principal delaying factor "has been the difficulty in getting delivery of electrical equipment and motors as a direct result of the prolonged strikes and material shortages which General Electric, Westinghouse

and Allis-Chalmers have all had to face during the past year."

These figures indicate sheet and strip steel output this year will exceed 1941 output by about six per cent. However, this does not supply an accurate means of measuring probable vehicle output because, in 1941, defense production was substantial and this year there is considerable uncertainty as to the proportion of sheet that will be allocated to the motor industry. Manufacturers will have to contend with the housing allocation controls of the Government and voluntary steel company quotas. Within recent weeks, the steel industry promised the Government to increase voluntarily its steel quotas for the railroad car building program sufficiently to step up this program from 3500 to 9000 units a month by June.

Steel company quotas control individual vehicle company production volume somewhat like car company quotas control individual dealer new vehicle sales volume.

The big difference is that car dealers have been getting close to their historical proportion of vehicle production, but the vehicle manufacturers haven't been getting their historical proportion of sheet and strip steel because of the abnormal demands by most industries. Prewar, the industry consumed nearly 40 per cent of flat rolled steel output. In 1940, it was actually 37.5 per cent. During the first seven months of last year, vehicle manufacturers received only about 25 per cent and in September the percentage moved up to 30.5 per cent.

Aside from these factors and possible strikes, there are two more essential considerations in calculating 1947 production. First, what will happen to replacement parts volume in 1947, how much steel will it require; and, Second, the grief and delay the steel industry and its supplier industries will encounter as a result of pushing production equipment to the limit.

(Turn to page 45, please)

Latest Automatic

Holds

Precision techniques extensively used in mass production of fuel injector parts at ultra-modern plant of General Motors Diesel Equipment Division in Michigan

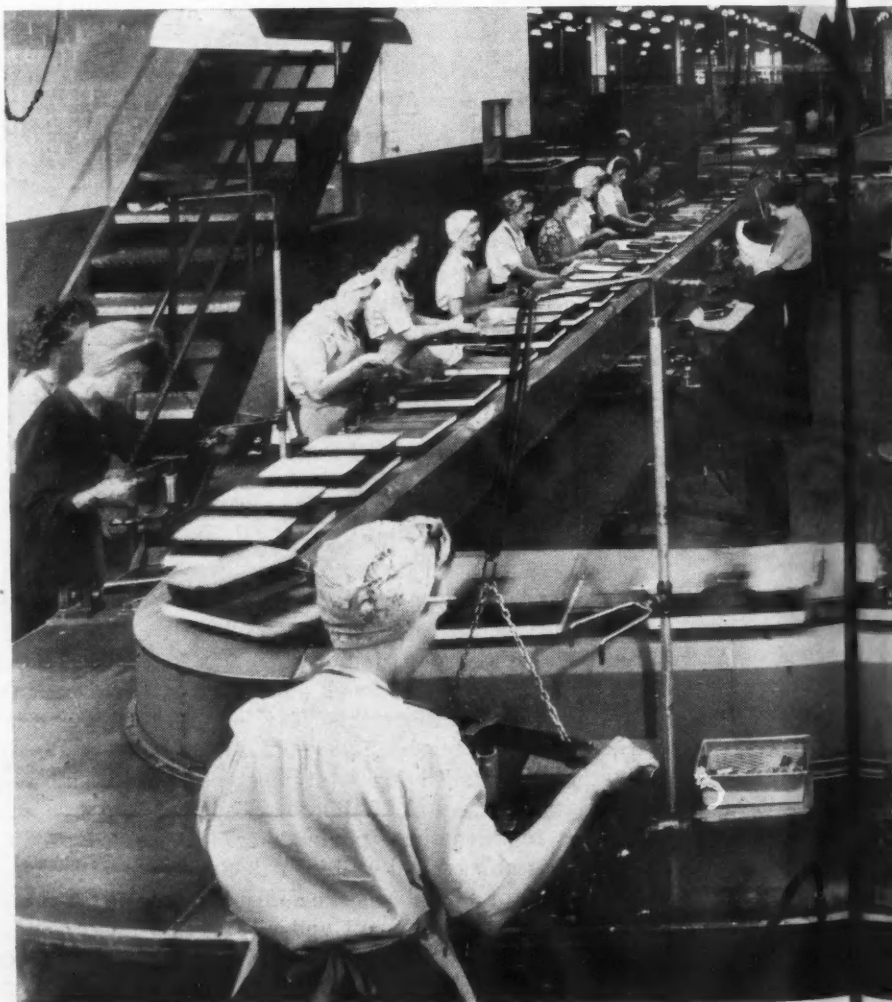
IN STRIKING contrast to the hand craftsmanship formerly employed in making precision parts, tolerances of the order of 30-millionths of an inch are being held in mass production by automatic machine methods by the Diesel Equipment Division, General Motors Corp., in its magnificent new plant in Grand Rapids, Mich.

The Division came into being in January, 1944, to meet the wartime demand for Diesel engine injector assemblies and spare parts for the General Motors Diesel Divisions, particularly for Detroit Diesel which was then accelerating its production of engines to meet the requirements of the Army, Navy, and other claimants. Starting from scratch, the Diesel Equipment Division built its output to a total of 3500 injector assemblies per day in the first year of operation.

Today the ultra-modern plant located in the southwest outskirts of Grand Rapids is equipped to meet any requirements of its four General Motors customers — Detroit Diesel Engine Division, Cleveland Diesel Engine Division, Electro-Motive Division, and Allison. The three Diesel divi-

sions are provided with fuel injector assemblies and parts, while Allison takes fuel spray nozzles and other precision parts for jet engines. In addition, the Division makes air heaters and heater pumps for pre-heating Diesel engine combustion chambers to facilitate cold weather starting.

Built on a 76-acre tract, the new plant boasts 250,000 sq ft of floor space of which 180,000 sq ft is currently used for manufacturing. It is of windowless construction with complete air conditioning for worker comfort. Excellent facilities for seeing are provided by an installation of fluorescent light sources, flooding all work places in the shop with 50 foot-candle intensity of light.



Unique mechanized final assembly line for fuel injectors. All parts for fuel injectors, after machining, lapping, and washing, are routed here for assembly

Machine Methods

Tolerance to 30 Millionth of Inch

By Joseph Geschelin

By the very nature of the parts produced here, the operation is designed to maintain a high level of quality as to surface finish, dimensional tolerances, and clearances of mating parts. It is no simple task, for example, to guarantee a clearance of 30- to 60-millionths of an inch between the plunger and bushing of a fuel injector. Yet this is accomplished entirely by machine methods and selective fits. Supplementing the machine methods, we find extensive instrumentation including a large installation of the familiar

Pratt & Whitney Electrolimit gages, Sheffield Precisionaire gages, and sensitive manometers designed and made here.

Plant layout has been developed skillfully to facilitate a smooth flow of operations. Machine shop departments occupy the entire central area of the building and wherever possible self-contained machine lines have been established for the production of individual parts. This is done on all large-volume parts—for example, the components of injectors for the 71 Series Diesel engines and for Allison nozzles. Thus they approach straight line mass production procedures for much of the volume routed through the plant.

Supplementing these centralized departments are the usual first operation lines—such as Brown & Sharpe screw machines; multiple spindle automatics, including large Conomatics and Greenlees; and an extensive heat treating department. The latter is fully equipped for all metallurgical processes—three groups of wet tumbling barrels for the burring of most parts; an installation of American Wheelabrator for shot-blasting; and electroplating equipment. Heat treating facilities include a battery of Leeds & Northrup Homo nitriding furnaces; a group of Lindberg Hydrolyzing furnaces featuring controlled atmosphere; General Electric drawing and hardening furnaces; and a battery of liquid salt bath and cyanide furnaces for case hardening. Machine lines present a bee-hive of activity with parts and assemblies scheduled for some 18 different types of products.

During the war when it was almost impossible to get forgings, injector bodies were made of Arma Steel, a product of the Saginaw Malleable Division, GMC. Now the bodies are made of steel forgings, which are normalized upon receipt, sand-blasted in the Wheelabrator and inspected. First major operation



Latest Automatic



Left—Group of Ex-Cell-O thread grinders, used for variety of parts including threading of injector bodies

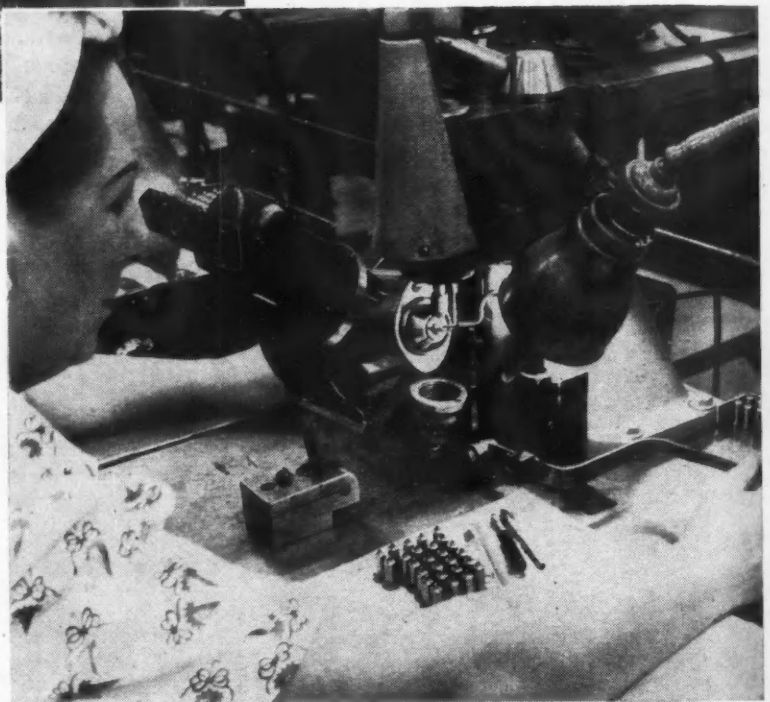
Below—One of the most unique operations is the drilling of the fine fuel spray hole in spray tips. This is a close-up of one of the special high speed, precision feed drilling units designed and built here for the purpose

is rough- and semi-finish broaching in a No. 5-54 Cincinnati Vertical Hydro-Broach. This twin-ram machine is fitted with an indexing fixture holding 12 pieces at a time. Following the severe roughing operations of broaching and core drilling, the forging is hardened, tempered, sand-blasted and inspected, ready for the main machining steps.

The center bore is finished to 0.531/0.532 in. on an H-6-36 American horizontal broaching machine, and after the chamfering operation, goes through a series of machining stages in Sundstrand automatic lathes. Later we find another surface broaching operation—broaching of the stamp pad and lifter notch in a No. 3-48 Cincinnati Vertical Hydro-Broach. Next comes a lengthy cycle of detail drilling and burring and polishing operations, eventually reaching the final grinding steps. Threads are ground in an Ex-Cell-O precision thread grinder which, incidentally, is used for all such external threading. The bushing joint face is ground on a No. 1 Brown & Sharpe universal cylindrical grinder and inspected following a series of burring, polishing, and washing operations. Final processing is in the heat treating department where the body is subjected to the "blue" bath, and the threaded portion tin-plated.

Injector Spray Tips

Injector spray tips for the 71 Series engines are made from ½ in. diam GM 6145 steel, in bars of 10 or 12 ft in length. First major operation consists of turning, forming the tip, and cut-off in a battery of No. 2-G Brown & Sharpe automatic screw machines. One of the most interesting operations on the tip is



the drilling of the six fuel spray holes, 0.0062 in. in diam. For this purpose, they have developed and built a group of special drilling machines illustrated here. Preliminary operations in the "green" are followed by degreasing, cyanide hardening, acid dip, rinse, and draw for ½ hr at 475 to 575 F. Hardness is held to 48-52 Rockwell C.

Grinding now follows, including—rough-grind of the small OD in a No. 2 Cincinnati Centerless Grinder, and grinding of the ID, followed by burring and polishing. Washing and blow-off prepare the work for another group of grinding stages—OD of the head in a No. 5 Brown & Sharpe cylindrical grinder, surface grinding of the head in a 6 x 18 Norton surface grinder, four pieces at a time, etc. Last major step is machining lapping of the face to precise dimensions and relationship of face and holes in a No. 8 Ultra-Lap disk type grinder. The fixture of this lap-

Machine Methods

(Continued)

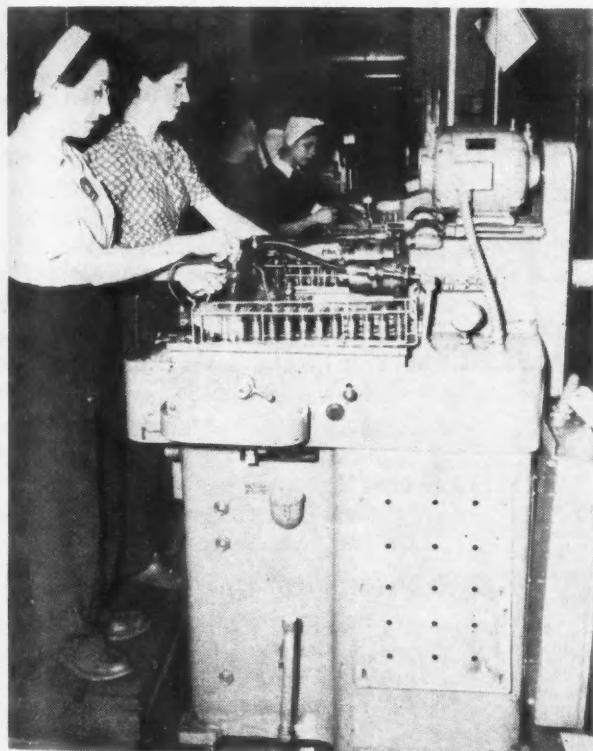
Here is one of several of the No. 5-54 Cincinnati vertical Duplex Hydro-Broach machines used for surface broaching certain faces of injector bodies

per holds 44 pieces at a time. Magnaflux method inspection and demagnetization used in accepting finished tips is a standard procedure on all such parts in this plant.

Injector Plunger and Bushing

The last two parts considered here are the plunger and bushing for the 71 Series engines. These are processed separately, then matched by selective assembly procedure in preparation for final assembly.

Plungers are produced from 13/32 in. round bar stock of GM 7520 alloy steel, the first major operation being facing, turning, forming, and cut-off in a bat-



Above—Following internal grinding, the plunger hole in the bushing is machine lapped in a battery of two-spindle horizontal type Micromatic Hydrohoners

Right—Bores in injector bodies are broached in this horizontal American broaching machine

tery of 1-in., six-spindle, Greenlee automatic screw machines. At the end of the initial roughing stage the parts are tumbled to remove burrs, then continue on a series of grinding, drilling, and milling operations. At this point the work is degreased, hardened, drawn, and sandblasted.

Next are the finish-grinding operations, ending in visual and dimensional inspection. Work is tumbled, de-scaled by hand, double-degreased, and nitrided in the L & N furnaces. Once again we have a series of grinding operations, Magnaflux inspection, final inspection, and the parts are now ready for assembly with plungers.

The final part considered here is the injector bushing

(Turn to page 56, please)



New Pressure Duration Testing of

THE trend toward a multiplicity of cylinders and high speeds which characterizes Diesel engine construction today has brought to the fore the need for an instrument for the continuous, or at least frequent, supervision of engine operation. The purpose of the supervision is to show the equality or non-equality of load distribution among the several cylinders and thereby to forewarn the operating personnel of any existing maladjustment and incipient trouble, and to aid in the attainment of good fuel economy.

The requirements for such an instrument are: that it should not encumber, or interfere with the functioning of the engine; that it should be reliable, sturdy, and easy to be mounted and operated by the regular engine room personnel; that it should be

consistent in its indication though not necessarily of extreme sensitivity; and finally that it should be of moderate cost.

There have been numerous efforts to satisfy this need. Various pressure indicators, recording and non-recording, mechanical, optical, and electrical, of the complete pressure cycle, the mean pressure, maximum pressure and exhaust pressure, and also exhaust pyrometers, have been adapted for this purpose, proposed, built and tried. But none of these instruments, meritorious and useful as many of them are, fill the requirements of this particular service completely.

In order to fill this need an instrument has been devised by the author, and developed at the Pennsylvania State College under the sponsorship of the U. S. Navy Department, which is believed to embody some useful advantages as compared with previous devices. This instrument is termed the Pressure-Duration Indicator and its function is to compare the high pressure portion of the pressure cycles in the several cylinders, or more specifically, to measure, in terms of crank angle, the duration while the engine pressure in the several cylinders surpasses a certain set and known pressure, say 500, 600 psi or more.

Principle of Operation

The pressure-duration indicator is based on the balancing pressure principle which has been widely used for the determination of periodically variable pressure phenomena such as the cyclic fluctuation of engine

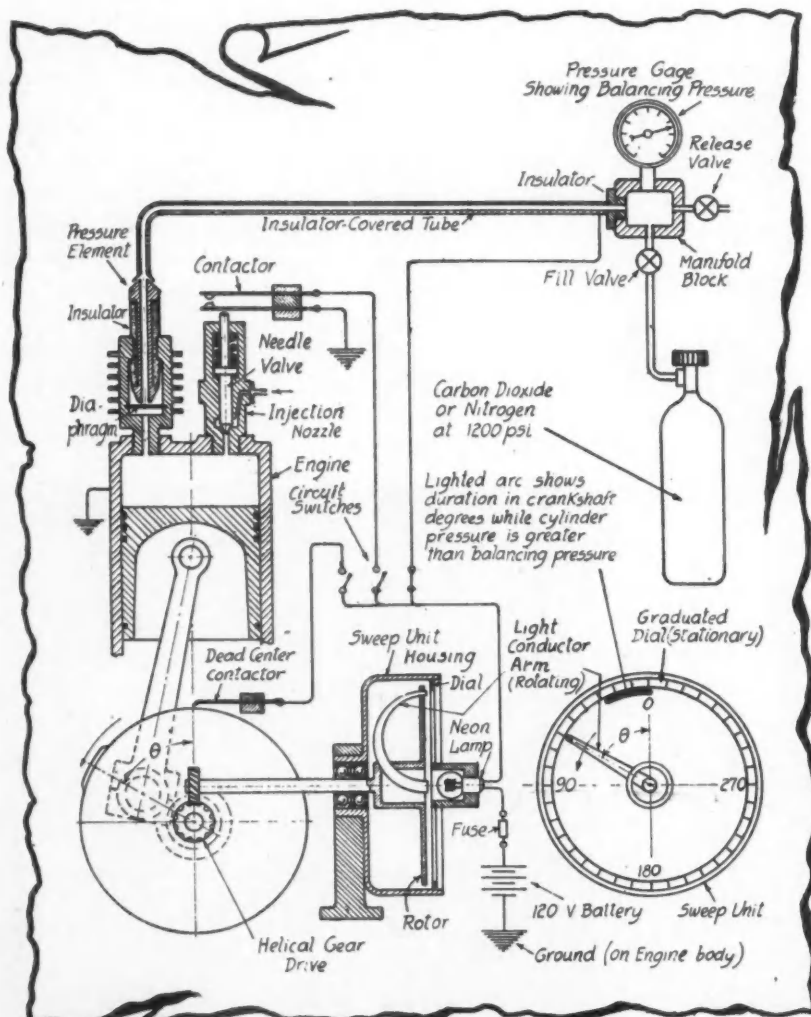


Fig. 1 — Pressure-Duration Indicator schematic arrangement on a single-cylinder Diesel engine.

(U. S. Pat. 2382547 and 2392581)

Indicator for Routine Multi-Cylindered Engines

By **Kalman J. De Juhasz**

Professor of Engineering Research,
The Pennsylvania State College

Part One

cylinder pressure which is a periodic function of the crankshaft rotation. Its essential elements are: (1) The container for the pressure balancing gas, termed the Manifold, in which the pressure can be altered at will and measured by a pressure gage.

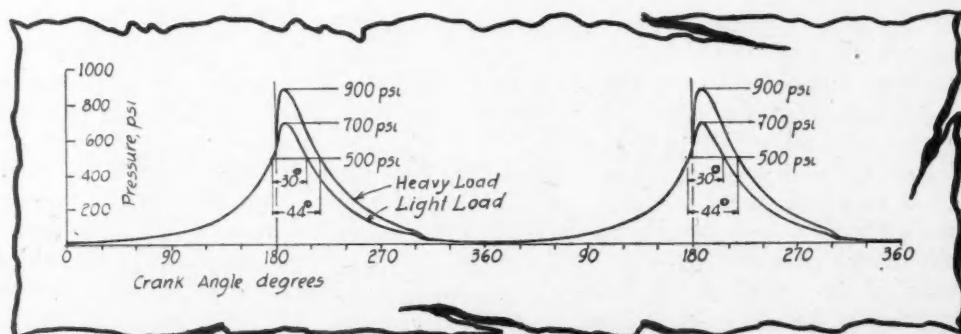
(2) The pressure-responsive electric contactor, termed the Pickup, which is connected to both the fluctuating engine pressure to be measured and to the set balancing pressure which is known. The Pickup makes an electric contact during those portions of the engine cycle while the engine pressure surpasses the balancing pressure. (3) A signaling device which is in this case a neon lamp placed in an electric circuit in series with the pickup. (4) An indicating device termed the Sweep Unit which is driven in synchronism with the engine crankshaft and which translates the light signals of the neon lamp into crank angle indications.

Ever since its discovery the balanced pressure principle has played an important part in the investigation and development of reciprocating engines, especially of internal combustion engines. It can be justly regarded as one of the most important and fruitful American contributions to experimental engineering. Therefore at this point a brief digression into its history may be of interest.

The balancing pressure principle was originated at the National Bureau of Standards about 25 years ago primarily for the testing of aircraft engines in altitude chambers. In its first conception, as described in the patent specification of Newell (1)* and in

*The numbers in parenthesis refer to the Bibliography at the end of Part II to be published in an early issue of AUTOMOTIVE and AVIATION INDUSTRIES.

Fig. 2 — Pressure-crank-angle diagram of two-stroke Diesel engine for light load and for heavy load.



the paper by Dickinson and Newell (2) it utilizes a water-cooled diaphragm-type pickup, a telephone for signal, and a timer-contactor for indicating the crankshaft phase. It was designed for laboratory use, for the attainment of the greatest accuracy and sensitivity, and it is a tribute

to the engineering skill of its designers, that even today, for laboratory use, the instrument has been unsurpassed, and it is widely used in its original design. A later, independently-conceived, British modification the so-called Farnborough indicator (3,4) uses a small, light valve as the pressure-responsive contactor, an induced spark as a signal, and a recording drum for making a pressure record as a function of crank angle rotation. The same instrument has been adapted by Ricardo (5) for the measurement of injection pressures, using a piston-type pressure-responsive element. The design of the Farnborough indicator exhibits a number of ingenious features aimed at convenience of operation and saving of time in the experiments. But the valve-type contactor and the method of spark recording have introduced some disadvantages and loss of accuracy. In order to obviate these disadvantages a German development (6,7) uses a diaphragm-type pressure element, a neon lamp signal, and a film-drum with photographic recording. The various types of balancing pressure indicators, and especially their pressure-responsive element, the diaphragms and valves, have been extensively investigated by the NACA (8,9) and the Bureau of Stand-

ards (12). Several improved and modified forms have been proposed and built by research institutions and engineering organizations, some of which have been described in patent and engineering literature (10, 11, 13).

Previous improvements and refinements of the balancing pressure indicators had for their object the increase of sensitivity, and other features for adapting it for research and laboratory work. In contradistinction with these endeavors the pressure-duration indicator, to be described in this article, has been developed mainly with increased ruggedness, simplicity and convenience in view, deliberately dispensing with extreme sensitivity, in order to adapt it to engine room conditions and usage especially for the supervisory service on multi-cylinder engines. Furthermore, it is adapted for the investigation not only of pressure, but also of other periodic engine events, such as the motion of the intake, exhaust, and injection valves, the knowledge of which may be helpful for proper engine operation.

Description and Operation of the Pressure-Duration Indicator

The pressure-duration indicator is shown schematically in Fig. 1 as mounted on a single-cylinder Diesel engine which is of the two-stroke type. The pressure-crank angle diagram of this engine is shown in Fig. 2. The Manifold Block, shown in Fig. 1 contains the balancing pressure medium such as carbon dioxide, nitrogen, or air, stored at high pressure in a container, and admitted to the manifold block through the Fill Valve. The manifold block is fitted also with a Release Valve, and a Pressure Gage. By manipulating the fill valve and release valve the balancing pressure can be set to any desired value (from zero up to the container pressure) and its actual value can be read on the pressure gage. The pressure medium is conducted to the pickup through an electrically insulated tube from the manifold. The pickup is attached to the cylinder head of the engine. The pickup is a hollow body formed with cooling fins, the inside of which forms a chamber that is divided into two parts by a flexible metal diaphragm. The lower part of the chamber communicates with the cylinder space of the engine. As the engine pressure is fluctuating, the communicating passage must be short

and free from obstruction, so that at any instant the pressure acting under the diaphragm is equal to the engine pressure. The upper part of the chamber communicates with the manifold, therefore the balancing pressure acts on the upper side of the diaphragm. Since the balancing pressure is kept constant—or changed only slowly, manually—the connecting tubing may be of any necessary length. The difference of pressures acting on its two sides will deflect the diaphragm away from that side at which the pressure is higher. The upper part of the pickup contains an insulated electrode which is drilled through to form a passage for the pressure balancing gas, and which is connected, outside the pickup, to the insulated tubing, and

through this latter to the manifold. It will be readily seen that whenever the engine pressure exceeds the balancing pressure the diaphragm will bulge upward and make contact with the insulated electrode. The pickup body and also the metal diaphragm are grounded through their metallic attachment to the engine. The electrode and the insulated tubing form parts of an electric circuit. Other elements of the series circuit are a wire attached to the tube near its entrance to the manifold, a circuit switch, a neon lamp, and battery, the other terminal of which is grounded. It will readily be seen, that (assuming the circuit switch to be closed) the circuit is controlled by the pick-

up: the neon lamp will be lit whenever and as long as the diaphragm makes contact with the insulated electrode, that is, whenever during the engine cycle the fluctuating engine pressure is greater than the balancing pressure; at the other parts of the cycle the neon lamp will not be lit.

It is now our purpose to determine the duration, in terms of crankshaft degrees, during which the neon lamp is lit. This is accomplished by means of the sweep unit, the essential part of which is a rotor driven by the crankshaft, through the helical gear drive shown in Fig. 1. The rotor carries a light conductor arm which extends radially from near the center of the rotor to its periphery. The light conductor arm is a suitably curved polished rod of lucite or other transparent and light-refracting material, having the property that light entering one end is transmitted

(Turn to page 67, please)

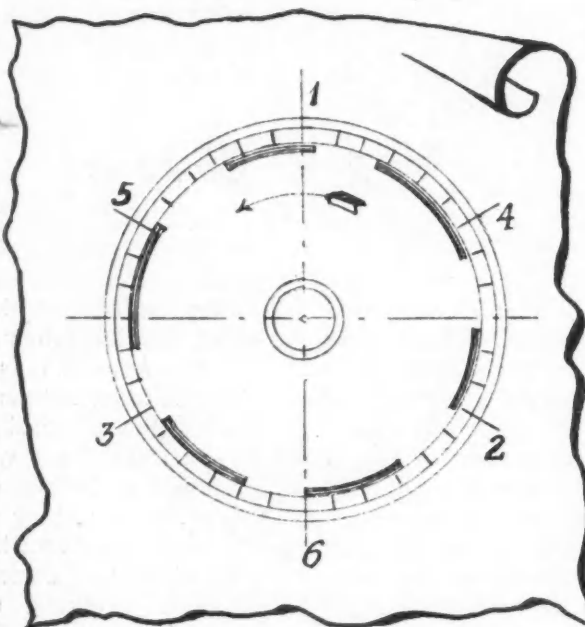


Fig. 3—Indication on sweep dial for a six-cylinder, four-stroke engine, showing unequal load distribution.

Unique Engine Assembly System

*Time and Labor Saved
as Parts and Accessories
Kits Flow on Con-
veyor Moving with En-
gine Assembly Line*

IN MODERNIZING the production of its varied line of Hivelo engines, the Buda Co., Harvey, Ill., has introduced a unique mechanized engine assembly system which is probably the first of its kind and may be prototypical. Both gasoline and Diesel engines, in the full range of sizes manufactured, are handled on this short, power-driven assembly conveyor of which a chief feature is the provision of engine parts and accessory kits filled completely for each specific engine and arranged in accordance with the building schedule.

The kits are grouped in individual racks moving on a rail parallel with the assembly conveyor and coordinated with the speed of the assembly line so that an engine block and case on the line is mated with the proper kit. This gives the worker all

(Turn to page 45, please)

In the storeroom at the Buda Co., complete parts and accessories required for the assembling of each engine are loaded on their respective racks moving on an overhead rail.

A power-driven overhead line, shown at the left in the photo, transports engine kits along with the moving engine assembly line.



THREE tandem-axle six-wheel trucks for heavy-duty hauling, and one four-wheel model of 30,000 lb GVW capacity have been added to the Federal Motor Truck Company's commercial vehicles, increasing its line to 17 different models currently in production. The new six-wheelers consist of the 663MA model of 40,000 lb GVW for heavy-duty highway operation with a road speed of 50 mph in direct gear and 59 mph in overdrive; the 664MAB of 55,000 lb GVW for heavy-duty on and off-highway work; and the 664MA of 55,000 lb GVW for off-highway operation primarily. Specifica-

tions of these six-wheelers are given in the accompanying table.

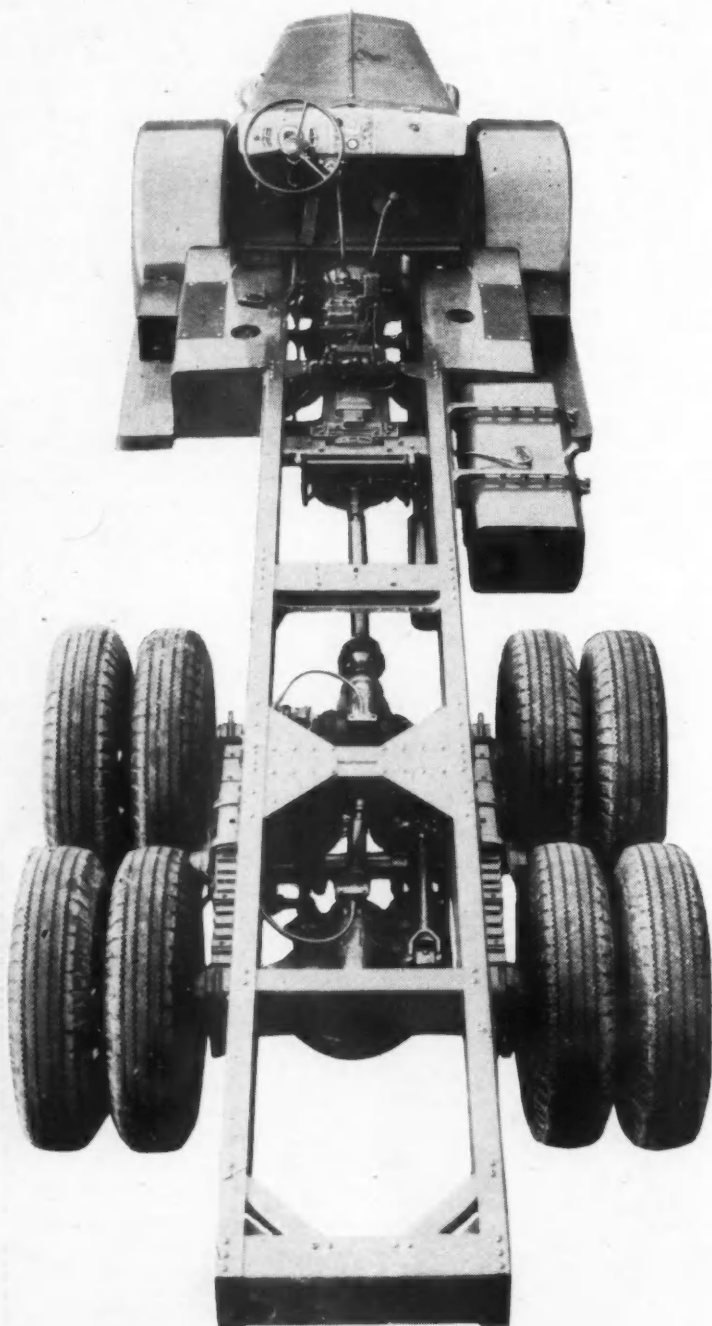
The six-wheelers use the six-cylinder Continental R-6602 overhead-valve engine (see April 1, 1946, A & AI, page 36) of 4.875 in. bore, 5.375 in. stroke, and 602 cu in. displacement. This engine is rated at 200 hp at 2600 rpm; and it develops 464 lb-ft torque at 1250 rpm. It can be converted to burn butane gas, using either Ensign or American Liquid Gas Equipment. Complete equipment is provided with the engine, including torsional vibration damper, dual oil filters, oil bath cleaner, Thompson Roto-Valves, and a Donaldson valve crankcase ventilating system with an air cleaner for the oil filler intake. An updraft carburetor is used.

These models are provided with a 12-volt electrical system, using two six-volt batteries to simplify the re-

New

placement problem and a 480-watt generator. A heavy-duty oil-filled and waterproof bus-type coil is employed, and the wiring harness is arranged for operation with a multiple fuse block. Other features include: an automatic hood light, gasoline filter, and solenoid type starting switch. An engine tachometer is standard equipment on the instrument panel. The engine carries a built-in mechanical governor limiting engine speed at 2500 rpm. A pressure cooling system is employed; and an automatically operating winter front can be supplied when specified.

On the high-speed 663MA vehicle, the operator can specify the Timken aluminum tandem rear axle which, through the use of light-weight aluminum for the housing, brake parts and hubs, aids materially in reducing deadweight. Timken front axles are used throughout.



This plan view of the 664MAB 201-in. wheelbase chassis shows the frame crossmember reinforcements.



Typical of the new Federal six-wheelers, as shown in the photo, is the massive construction of the radiator shell and guard which are made of heavy gage steel.

Federal Six-Wheel Trucks

Rear-end construction of the six-wheelers utilizes torque rods arranged in parallelogram to transmit driving and braking forces from the axle to the frame. The latest B-W air-compressor is featured on these models. This is a two-cylinder, water-cooled unit of 12 cu ft capacity; and it is mounted at the front end of the engine. A front-wheel brake limit valve is installed as regular equipment. All chassis are provided with 62 gallon fuel tanks, and an additional 62 gallon tank is optional.

Chassis frames have been developed with a view to freedom from failure under extreme operating conditions by eliminating areas of stress concentration. The frame reinforcement system consists of two inner angles and a carefully patterned fishplate of 5/16 in. thickness, all cold-riveted to the side rails. The fishplate is omitted on the short wheelbase 663MA, however, since the two angles offer sufficient strength.

One of the basic sales features of the Federal line is that of providing the vehicle with complete equipment as part of the standard priced package. This is true of the cab as well as of the chassis. For example, the

windshield wipers are air driven and two are fitted as regular equipment. The same is true of sun visors, rear-view mirror, adjustable seat and back cushions, (Turn to page 56, please)

Federal Six-Wheel Truck Data

Model.....	663MA	664MAB	664MA
GVW.....	40,000 lb	55,000 lb	55,000 lb
Engine.....	R-8602	R-8602	R-8602
Clutch.....	Lipe-Rollway 15 in.	Lipe-Rollway 15 in.	Lipe-Rollway 15 in.
Main Transmission.....	Fuller 5A65 (8.08 low)	Spicer 7741 (6.27 low)	Spicer 7741 (6.27 low)
Main Transmission Speeds.....	5	4	4
Auxiliary Transmission.....	Spicer 703F	Spicer 703F	Spicer 703F
Auxiliary Trans. Ratios.....	0.84 and 1.495	0.84 and 1.495	0.84 and 1.495
Rear Axle.....	Timken SW-3012	Timken SW-456	Timken SD-426
Rear Axle Ratio.....	6.167	7.6	8.15
Universal Joints (Three).....	Spicer 1600-1700	Spicer 1600-1700	Spicer 1600-1700
Wheels (in.).....	Budd 11 1/4	Budd 13 3/16	Budd 13 3/16
Tire Size—Standard.....	10.00-20	11.00-22	11.00-22
Tires—Oversize.....	10.00-22	11.00-24	11.00-24
Steering Gear.....	500 Gemmer	500 Gemmer	500 Gemmer
Brake Shoe Size:			
Front (in.).....	17 1/2 x 3	17 1/2 x 4	17 1/2 x 4
Rear (in.).....	16 1/2 x 6	16 1/2 x 7	17 1/2 x 5 1/2
Brakes.....	B-W Air	B-W Air	B-W Air
Fuel Tank.....	62 gal	62 gal	62 gal
Frame Side Rails (in.).....	10 5/8 x 3 x 5/16	10 5/8 x 3 x 5/16	10 5/8 x 3 x 5/16

Dimensions for All Models

Wheelbase (in.)	CA (in.)	Body Length (ft) (Approx.)
189	108	16
201	120	18
213	132	20
225	144	22

FORMERLY there were essentially three factors limiting the maximum sustained output of an engine of given displacement, namely, the breathing or pumping capacity of the cylinders; the load-carrying capacity of the crankshaft bearings; and the ability of such parts as exhaust valves, pistons, and piston rings to withstand high temperatures. Recently the breathing capacity has been either eliminated as an output-limiting factor by the provision of a blower or supercharger, or reduced in importance by lowering the resistance to flow of the inlet tract. Thus, the output-limiting factors were reduced to two, and development engineers concentrated on these. A further increase in specific output was called for particularly in the case of aircraft engines, because if the specific output is raised the engine weight can be reduced and the payload capacity or the performance of the plane increased accordingly.

Research directed toward the improvement of engine bearings was stimulated by the war, which made it necessary to increase the performance of aircraft, tank, marine and other engines of fighting equipment to the utmost. While the war lasted the results obtained naturally were kept secret, but recently much of what was learned has been made available to the general public. At the annual meeting of the American Society for Metals, held in Atlantic City some time ago, a symposium on progress in bearing metals was held, and among the papers contributed were the following:

"Fundamental Considerations Concerning the Behavior of Bearings," by R. W. Dayton, Battelle Memorial Institute.

"The Selection of Bearing Material," by Arthur F. Underwood, General Motors Research Laboratories Division.

"Mechanical Features of Steel-Backed Bearings," by E. Crankshaw, Cleveland Graphite Bronze Co.

Latest Developments in

Part One — Bearing Materials and Bearing Types

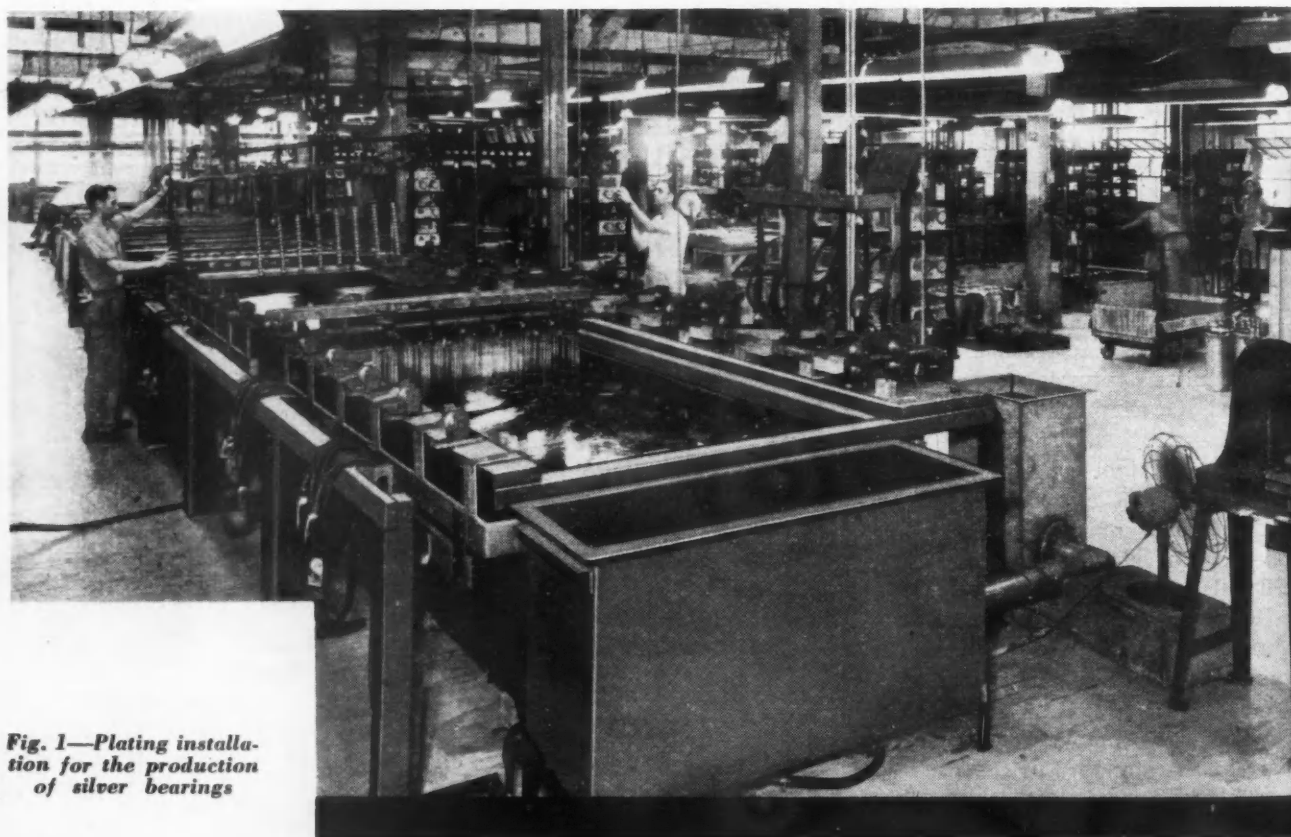


Fig. 1—Plating installation for the production of silver bearings

By
P. M.
Heldt



in Engine Bearings

"Newer Bearing Materials," by I. C. Sleight and L. W. Sink, P. R. Mallory & Co., Inc.

"Aircraft Engine Bearings," by J. Palsulich and R. W. Blair, Wright Aeronautical Corp.

In addition to the above, a "Technical Note" on one particular phase of the general subject was issued by the National Advisory Committee for Aeronautics, viz., T.N. No. 1108, "Load Capacity of Aluminum-Alloy Crankpin Bearings as Determined in a Centrifugal Bearing Test Machine," by E. Fred Macks and Milton C. Shaw, Cleveland Aircraft Engine Research Laboratory, NACA.

Of the various papers listed, the last two deal exclusively with bearings suitable for aircraft engines, while the other four cover all types. It is rather difficult to make a sharp distinction between bearings for aircraft and automobile engines. Evidently any crankshaft or connecting-rod bearing which gives satisfactory service in an aircraft engine will meet all service requirements also in an automobile engine, but its production costs may be too high for the latter application. As already stated, an increase in the specific output of an aircraft engine makes possible an increase in the payload capacity of the plane; and even at a very moderate rate per ton-mile, the value of an additional pound of payload, over the useful life of the plane, is so great that it warrants a relatively high expenditure on critical parts affecting the payload capacity. In the case of automobile engines the economic value of a gain in specific output is less, and restrictions on production costs therefore are more rigid.

Part I of this article, which deals with the subject of bearings in a general manner, is based mainly,

though not exclusively, on facts and figures presented in the first four papers listed. Part II, which deals with bearing production, testing and inspection methods in the aircraft industry and with materials for aircraft-engine bearings, is based almost entirely on the two papers at the end of the list and will be published in an early issue of *AUTOMOTIVE AND AVIATION INDUSTRIES*.

So far as engine applications are concerned, a bearing metal may be defined as one which when reasonably well lubricated will carry considerable specific load at high rubbing velocities without giving rise to failure through scoring or fatigue. Quite a number of different bearing metals are now available, and they naturally divide into two classes. Those in one class are sufficiently soft so that they may be used on the conventional crankshaft of heat-treated medium-carbon steel without causing undue shaft wear, while those in the other class are harder and call for a special hardening treatment of bearing surfaces on the shaft, if wear is to be held within permissible limits. When the shaft wearing surfaces are hardened by a process such as the Tocco, the hardness will be of the order of 500 Brinell, while that of the conventional heat-treated crankshaft is only about 250 Brinell. The first class of bearing metals includes tin-base, lead-base, and cadmium-base white metals, while the second includes aluminum-alloys, copper-lead, tin-bronze, lead-bronze, and silver.

The requirements in engine bearings were concisely stated by Arthur F. Underwood in his ASM paper as follows:

1. Score resistance.
2. Compressive strength.

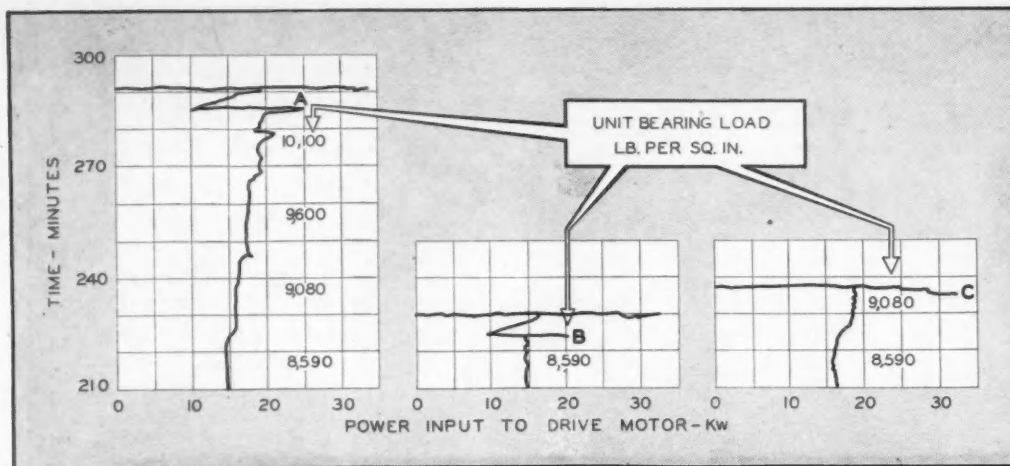


Fig. 2—Wattmeter records (final portions only) of load-capacity tests on three types of bearings (National Advisory Committee for Aeronautics)

3. Fatigue strength.
4. Deformability.
 - a. Conformability.
 - b. Embedability.
5. Corrosion resistance.
6. Structure.

It seems to the writer that the last item, structure (or grain size), might be omitted from the list, because it affects the behavior of the bearing only indirectly, through its effects on some of the other factors, such as fatigue strength and corrosion resistance. As regards the item of structure in silver bearings for aircraft engines, Palsulich and Blair say that at one time the Wright specifications called for a fine grain in the silver, but the current specification does not put a limit on grain size, because tests have shown that a large grain size has no detrimental effect on the bearing performance. Structure or grain size in the list of requirements might possibly be replaced by heat conductivity. Both scoring and fatigue failure are induced by excessive local heating and, other things being equal, such excessive heating is less likely to occur with a bearing metal of high heat conductivity. With respect to heat conductivity the various bearing metals in the pure state rank as follows: silver, copper, aluminum, magnesium, zinc, cadmium, tin, nickel, lead. The conductivity coefficients of silver and copper are more than 10 times as large as that of lead.

A study of the above list of requirements shows that they are conflicting and cannot possibly be met by any single metal. For instance, pure lead and tin by reason of their relative softness possess high embedability, but they lack compressive strength, especially near the upper end of the temperature range encountered in bearing practice. For this reason the practice of using solid bushings of one material has been discontinued where heavy loads and high speeds must be withstood. Embedability is required only in the surface layer, and in heavy-duty bearings strength is provided by a backing of a stronger material, usually either bronze or steel. Bronze came into use first as a backing material, but was later replaced by low-carbon steel, which has a higher yield point under compressive loads. At present there is

said to be an inclination to go a step further in this direction, by replacing the carbon-steel with alloy-steel backings.

The rapid increase in the specific output of aircraft engines during the past several years resulted in such increases in the specific bearing loads that steel-back babbitt bearings, and even copper-lead bearings did no longer give a satisfactory bearing life, and shortly before the beginning of World War II silver was introduced as a bearing material for such engines. The first attempts were not entirely successful, apparently because silver does not have sufficient embedability. This difficulty was overcome by providing the silver lining with a thin overlay (0.001 in.) of lead, a material of high embedability. In the pure state lead is not very corrosion-resistant in crankcase oil, and trouble from corrosion was guarded against by alloying the lead with about 5 per cent of indium. In production the indium is electrodeposited on the lead and then diffused through it by heating. Alternately, the lead may be alloyed (codeposited) with tin to increase its corrosion resistance.

These silver bearings with a thin lead-indium overlay became the standard for aircraft master-rod and knuckle-pin bearings during the war, and were produced in very large numbers. Originally the silver was cast to the steel backing, but this proved unsatisfactory because, when thus cast, the silver does not bond well to the steel; and it is also likely to have a porous structure. Electrodeposition therefore was resorted to quite early in the history of silver bearings, and the process was gradually developed until it was possible to deposit the metal at the rate of 0.015 in. per hr in regular production, and more than three times as fast experimentally. To produce a reliable bond, the backing is first given a thin coating of copper. A plating installation for silver bearings (Malory) is shown in Fig. 1. The silver is deposited to a thickness of about 0.020 in.

Aluminum

Whereas silver seems to have secured a firm hold as a material for aircraft engine bearings, the use of aluminum or, rather, aluminum alloys for that pur-

pose is as yet only in the development stage, at least as far as American practice is concerned. That certain aluminum alloys possess good bearing properties has long been known from their use for pistons, and the Rolls-Royce firm in England has been using aluminum bearings for at least a decade. Early in 1946 aluminum alloy bearings were introduced in some makes of American Diesel engines. There is, of course, an endless variety of possible aluminum alloys, but for piston purposes two general types have been developed, containing appreciable percentages of copper and silicon respectively. In the bearing alloys which have been developed so far the principal alloying element is tin, which, when used is present usually in the proportion of 6 to 7 per cent. Tin improves the embedability and non-scoring properties of the alloy, but it is of no particular help as regards mechanical strength. Greater bearing-load capacity can be obtained with this type of alloy by the addition of about 1 per cent each of copper and nickel; and an alloy containing about 6 per cent of tin and about

aluminum alloy is bonded to a steel backing, the same as in modern babbitt and copper-lead bearings. At present, bearing metallurgists are working on processes for securely bonding the aluminum alloy to the backing. That the problem has not been fully solved as yet is indicated by one of the conclusions drawn from the results of load-capacity tests made by the NACA, that "the physical characteristics of the bond between the aluminum alloy and the steel back must be improved before the aluminum alloy can be used for radial aircraft-engine master-rod bearings." It seems, however, that several firms have succeeded in developing a fairly satisfactory bonding process, as material so bonded is being produced on a commercial scale.

In the NACA tests it was found that aluminum bearings seize more suddenly and more severely than comparable copper-lead and silver-lead-indium bearings. On the other hand, whereas the shaft is almost sure to be ruined by the seizure of a silver bearing, it is practically never injured by seizure of an aluminum bearing. With respect to embedability, aluminum alloys range between silver and babbitt, and are practically on a par with copper-lead.

Copper-Lead

Another bearing that has higher load-carrying capacity than the conventional steel-back babbitt type is the copper-lead bearing. This type has been known for nearly 20 years, and no significant development work seems to have been done on it during the war period. A comparison of the load-carrying capacities of a silver bearing with lead-indium overlay, a copper-lead bearing, and an aluminum alloy bearing is made in Fig. 2. The chart shows the upper or final parts of wattmeter records taken from the electric motor driving the bearing testing machine, the watts registered representing the power losses in the bearings. The data for the three bearings tested are as follows:

Bearing A (left): steel-back, silver-lead-indium bearing with 0.021 in. silver, 0.001 in. lead, and indium equal to 4 per cent of the weight of the lead into which it was diffused. Average load capacity: 10,300 psi (3840 rpm). Average diametral clearance: 0.004 in.

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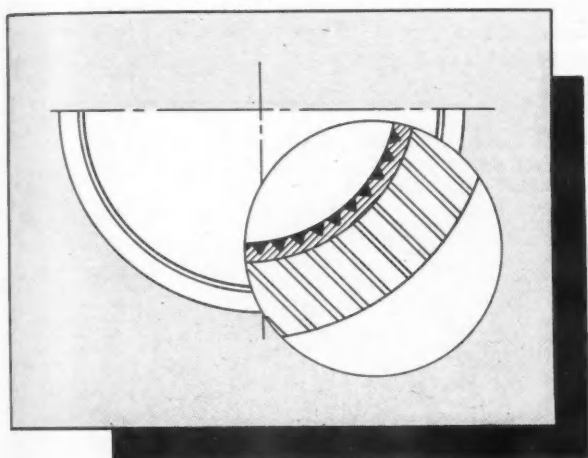


Fig. 3—End view of grid bearing with enlarged view of section

1 per cent each of copper and nickel seems to be about the best as far as load capacity is concerned. Another alloy used for bearing purposes contains about the same amount of tin together with about 2.5 per cent silicon; while in a third the tin is replaced by about 4 per cent of cadmium, which is used together with about 4 per cent silicon.

One of the most valuable characteristics of aluminum bearings is their corrosion resistance. While aluminum alloys are not entirely corrosion-proof, they do not seem to be attacked by any of the corrosion agents that find their way into crankcase oil.

Aluminum-alloy bearings are produced in two forms, as solid bushings of the alloy and as composite bushings with a steel backing to which a thin layer of aluminum alloy is bonded. One property that distinguishes aluminum from other bearing materials is its relatively high coefficient of heat expansion. To eliminate trouble arising from differential expansion in applications where bearings loadings run high, the

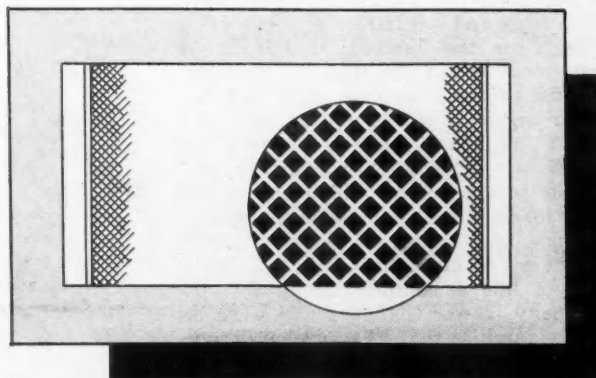


Fig. 4—Plan view of grid bearing with enlarged view of grid pattern

Late Slants on High Prices

By Leonard Westrate

AUTOMOBILE prices are too high. Everyone agrees to that—automobile manufacturers, dealers, and especially buyers who have to pay from 50 to 60 per cent more than they did in 1941.

While everyone manufacturing and selling automobiles believes that present price tags are too high, not much that is so far discernible has been done about it. The reason is that despite rumblings that the buyers' market is approaching, manufacturers still sell at present prices all the automobiles they can make. It is true that the situation has eased a little since last Fall, but with the exception of two lines the buyer still can expect to wait from two to eight months for delivery.

From all available evidence it looks as though Ford, Chevrolet, Plymouth, and Studebaker are farthest away from a buyers' market. Many dealers report that they have not accepted orders for as long as six to nine months and that they want to catch up with back orders before taking new ones.

One reason that the lower priced lines will be the last to feel the impact of price resistance is that prospective purchasers who find price tags too steep in the higher priced lines simply step down to the next price class. Cancellations, however, have been relatively few. In short the general situation is that up to now there has been a top layer of purchasers who have been able and willing to pay the price asked for the limited production of cars to date. But the unknown quantity in the equation is how thick the top layer is and when it will be skimmed off. There is not much doubt that the percentage of new cars thus far sold to the income group which before the war made mass volume sales possible is very low indeed.

There are no definite data available as yet but a sample survey by one company showed that about 70 per cent of the families that had purchased new cars have incomes of approximately \$3000 and up a year. While the sampling was too small to be significant, it certainly indicates a trend. A more direct survey shows that factory workers

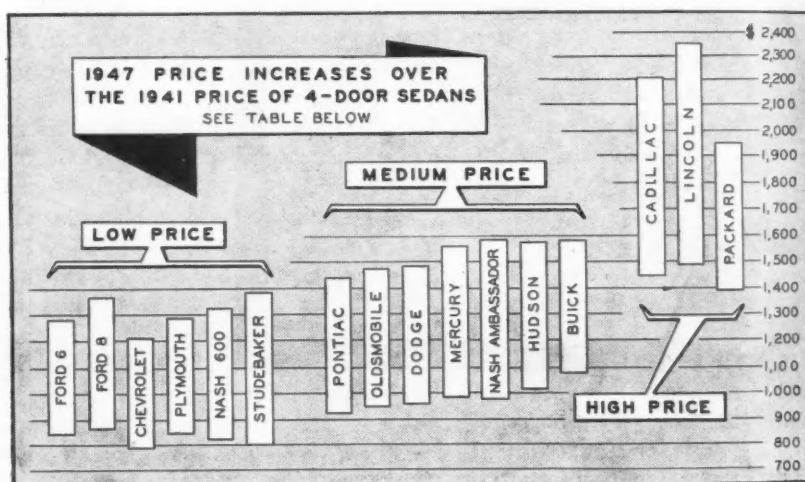
in general are not buying new cars in any quantity.

According to available statistics, about 37 per cent of all new cars purchased in 1941 were bought by families with an income of less than \$3000. Sixty-five per cent of the low priced cars sold that year were purchased by this same group. While individual fac-

tory workers income undoubtedly has risen since 1941, living expenses and other costs also have kept pace so that the amount of money left for the purchase of a new car probably is no greater than it was then and the price of the new automobile has risen approximately 50 per cent. Dealers covered by the survey stated that they did have orders on hand from factory employees but many of them thought that the percentage was down very considerably from prewar days.

Another important factor that has not yet been felt very seriously but is beginning to show up is the Federal Reserve Board Regulation W, controlling credit. Under the ruling, the purchaser must pay at least 1/3 down and must pay the balance in a maximum of 15 months. Thus, if an average car

(Turn to page 54, please)



Delivered Prices of 1947 Four-Door Sedan at Town Nearest Factory

Includes factory list price with standard equipment plus Federal Taxes.

	1941	Jan. 30, 1947	% Increase	
Low Price Class	Ford Super Deluxe 6	\$843	\$1277	51.4
	Ford Super Deluxe 8	859	1365	58.9
	Chevrolet Stylemaster	795	1205	51.5
	Plymouth Deluxe 6	845	1292	52.9
	Nash 600	810	1319	62.8
	Studebaker, Champ. Deluxe ..	800	1388	73.5
Medium Price Class	Pontiac Torpedo 6	921	1433	55.5
	Oldsmobile 6-66	945	1471	55.7
	Dodge Deluxe 6	954	1492	56.3
	Mercury 8	987	1562	58.2
	Nash Ambassador 6	980	1589	62.1
	Hudson Super-Six 51	1006	1574	56.4
	Buick Series 40	1082	1580	46.0
High Price Class	Cadillac V-8—61	1445	2203	52.5
	*Lincoln	1490	2341	57.1
	Packard Deluxe Clipper	1396	1947	39.5

*Does not include spare tire as standard equipment

Future Foreign Trade and the Geneva Negotiations

AMA Renews Its Endorsement of American Reciprocal Trade Agreement Policy

By James R. Custer

IN THE next few weeks another international problem will come to the forefront when representatives from 19 nations meet in Geneva, Switzerland, to negotiate trade agreements that will determine to a large extent the pattern of their peacetime foreign commerce. Bargaining at the conference, scheduled to begin April 8 and likely to continue through most of the summer, will be between individual countries, but any of the agreements when finally approved by the respective governments are intended to apply to the other represented nations since the purpose is to eliminate the preferential tariff system. In other words, if two nations agree to lower or eliminate tariff duties on certain commodities to stimulate trade between them, the tariff concessions also are available to the other countries that participated in the conference.

At the present time there is a growing opposition in Congress to certain provisions in the Reciprocal Trade Agreements Act of 1934, but as yet there is no indication that it will be strong enough to prevent the United States being represented at Geneva. Some Congressmen are said to be in favor of returning the setting of tariff duties to the Tariff Commission, thus superseding the State Department which has had charge since 1934.

According to plans the United States will be represented at Geneva by about 12 teams of economic specialists from seven Government agencies—the Tariff Commission and the Department of State, Commerce, Agriculture, War, Navy and Treasury. The Department of State has announced that all future trade agreements will include an escape

clause, similar to the one in the agreement with Mexico, which will permit the President to take action to protect any industry or agricultural activity seriously threatened by operation of any agreements. Extending the purpose of the reciprocal trade agreement principle, which had its inception after the 1850's during the high tariff and free trade controversies, the Administration is advocating the formation of an International Trade Organization. Under the 1934 act the United States now has trade agreements with 25 foreign countries.

Hearings on reciprocal trade were held during January in Washington, at which hundreds of witnesses representing manufacturers, labor, agriculture, importers and exporters testified before the Committee for Reciprocity Information, a Government interdepartmental agency. Some industries, particularly those that had an unusual production expansion during the war, want to become active in foreign markets. The Government experts will use the information presented at the Washington hearings as a basis for determining the extent of tariff concessions at the Geneva negotiations.

Data on the automotive industry were submitted by the Automobile Manufacturers Association and its position with respect to the Reciprocal Trade Agreements Act is given in the following paragraphs prepared especially for AUTOMOTIVE AND AVIATION INDUSTRIES by George Romney, AMA general manager. It will be recalled that before the war certain foreign countries had set up tariff barriers to keep American passenger cars and trucks out of their domestic markets

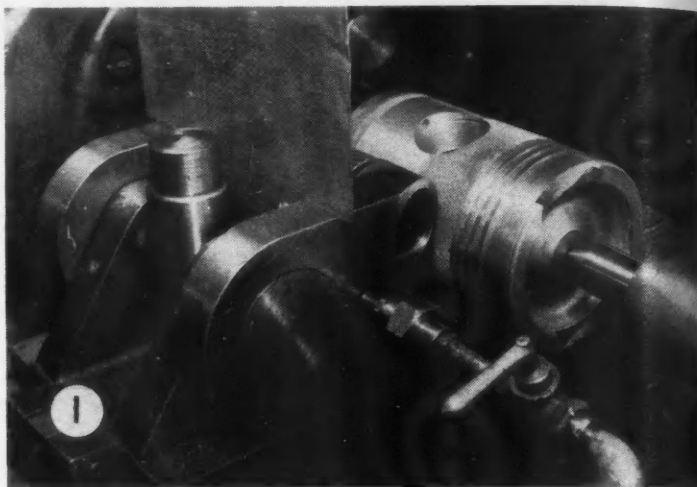
and as a result since 1929, when the number of United States-built automobiles in foreign countries was 50 per cent of total registration, the proportion declined to 38 per cent in 1939. The AMA statement follows:

"The Automobile Manufacturers Association has consistently endorsed the Trade Agreements Act since its enactment in 1934, and has supported the State Department in its efforts to improve our foreign trade through negotiation of trade agreements. Sound foreign trade must be on a two-way basis. The association accordingly welcomed the announcement that 18 nations would meet to renew negotiations on a wider basis, to improve the world economy through greater international trade.

"The volume of foreign trade is directly dependent upon the degree to which restrictions on initiative and enterprise are removed. Correspondingly, a high level of interim economic development in any country requires efficient transportation, the automotive industry has made a substantial contribution to this end in the past, and can make constantly increasing contributions in the future. An appreciation of the value of motor transportation is shown by the fact that virtually every country of the world is engaged in the planning, or actual construction, of extended highway facilities.

"In many countries the restrictions placed upon the importation of motor vehicles reflects a gap in the integration of national policies which seek the upbuilding of the internal economy. It is recognized that these restrictions sometimes stem from causes—as for example exchange shortages—which make their removal difficult. More often than not, however, they exist because of lack of appreciation of the benefits increased motorization can bring, and a short-sighted concern for the revenues which high tariffs are assumed to provide. Fundamentally, there is little doubt that the peoples of foreign countries recognize their basic requirements in highway transport, and that they can be brought to take the longer view of the benefits which increased motorization provides."

Piston Tooling Innovations



1. Zollner method of producing serrated piston skirts. The operation is done in a LeBlond lathe using an hydraulically operated serrating attachment shown in the foreground. One of the cutters may be seen at the top, the other is mounted below.

MAKING pistons for motor trucks, buses, tractors, and industrial applications in diameters of from 1½ in. to 9 in. is an operation which must be based on short runs and frequent change-over. The Zollner Machine Works, of Fort Wayne, Ind., which specializes in this type of product, recently completed a major conversion to civilian production. Its plant, which employs unique techniques and much specialized tooling designed primarily for use with general purpose machinery, is laid out in U shape with machine shops in the two legs. One of these is set up for rough machining, the other for finishing operations. The rough machining area also includes an experimental machine shop for engineering department jobs and for some special runs.

Considering the variety of sizes and details of pistons by Zollner it is of interest to note that a procedure has been developed that is applicable to the making of almost any kind of piston in any volume. This has been accomplished by the design of interchangeable fixtures and tooling, all of similar character, which can be readily changed over to suit a specific job.

Because Zollner specializes in aluminum alloy pistons exclusively, practically all operations—except drilling, milling, and grinding—employ tools tipped with cemented-carbides. In general the processing of pistons follows the pattern below:

1. Centering of the rough piston casting: (a) boring the open end; (b) center drilling the head.
2. Rough boring of the piston pin hole on a single-end Heald Bore-Matic using a special hydraulically operated work-holding fixture having four stations. This step establishes a definite base for all succeeding operations.
3. Facing the head. This is done in LeBlond lathes, using an hydraulically operated tool head with a cam mechanism for producing a radius head where specified.
4. Rough turning and rough ring grooving.
5. Inspection of roughing stages.
6. Finish turning of ring grooves and ring lands to specified tolerances.
7. Cam grinding in Cincinnati external grinders fitted with standard cam grinding attachment or special Zollner cam grinding attachment, depending upon design.
8. Tin plating or anodizing, depending upon customer's requirements.
9. Final step is finish line boring of the piston pin bore

in a single-end Heald Bore-Matic fitted with a two-station work-holding fixture.

10. Final inspection.

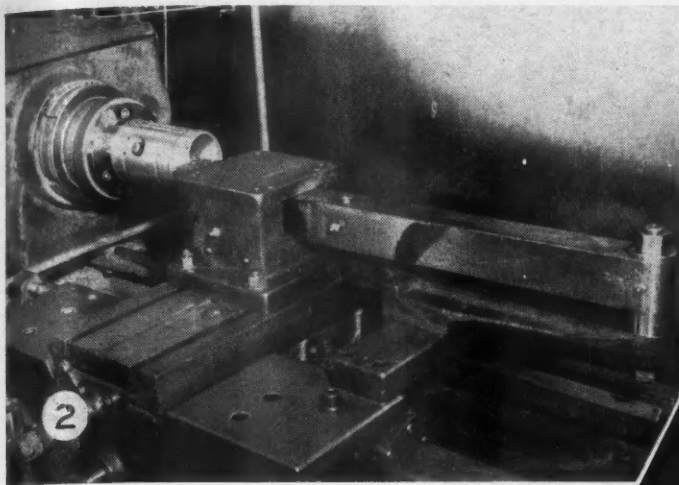
Because of the great variety of drilling and slot milling details, these operations have been omitted from the routing given above. Obviously Zollner cannot employ single-purpose set-ups such as are featured in passenger car piston lines. Instead they rely upon single-spindle drills fitted with special holding and indexing fixtures for all drilling; and general purpose milling machines for all milling. Nevertheless, their specially designed fixtures and procedures make it possible to handle drilling and milling in all its variations economically.

Stamping piston identification on the head is an operation which may cause distortion. To meet this problem, Zollner has developed a simple hydraulically operated machine fitted with a steel roller for stamping. The mechanism is so arranged as to control the pressure on the roller and to vary this pressure according to the design of the piston. The job is done quickly and without distorting the piston.

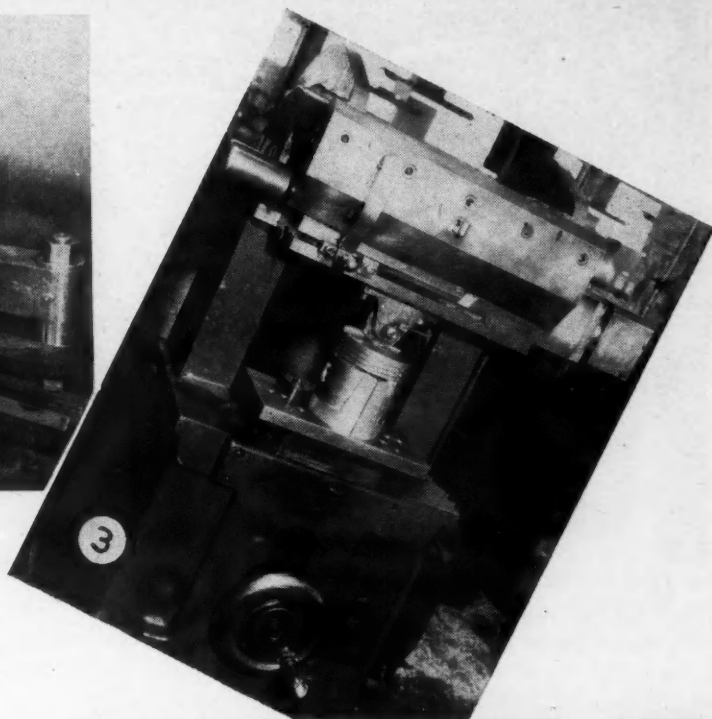
A feature of Zollner design is a patented "controlable" cam profile in which the skirt not only is cam-ground to give the proper dimensions on the two principal axes but also to provide a controlled tapering effect—smaller diameter at the top than at the bottom, or the reverse; or any variations in diameter in between. This is accomplished through the use of a variable cam generating attachment fitted to the Cincinnati external grinders. An important feature of the cam generator is the facility with which it can be accommodated to suit any size or type of piston processed over a given grinder.

The pin hole finish boring operation on the Heald is held to extremely fine tolerances. To assure absolute alignment of the through bore, the fixture features a line-up bar made to fit the rough-bore size. This is passed through the bores before the fixture is locked, thus effecting positive alignment, then the finish-bor-

(Turn to page 45, please)

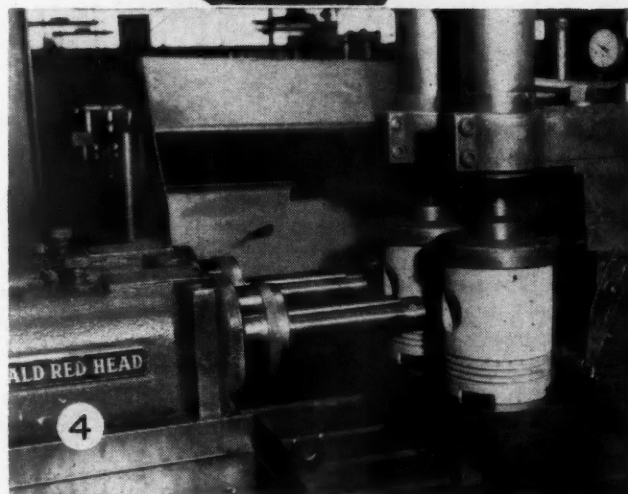


2. Piston head facing is done in LeBlond lathes with tooling depending upon the type of piston being machined. In this case the piston has a dual-concave head and the formation is developed by means of the hydraulically controlled radius arm seen in the center. In all cases the piston is drawn up against the chuck by means of a pin through the rough-bored pin holes.

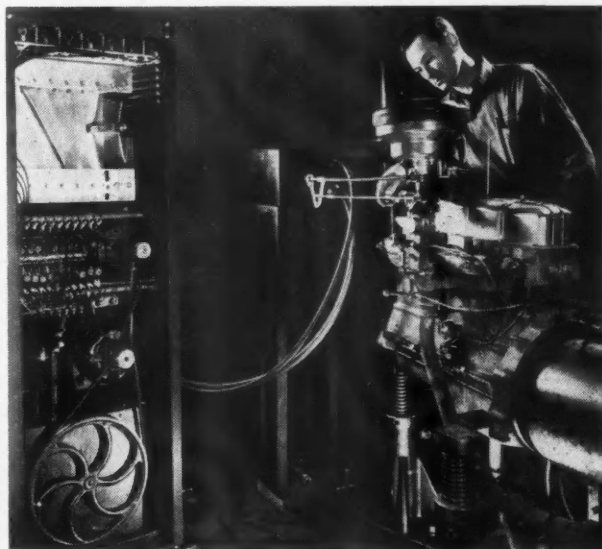


3. This is the specially designed hydraulically controlled machine for automatic stamping of piston identification. The roller resting on the piston head does the marking under controlled pressure adjusted for each type of piston.

4. Plated pistons are finish-bored in two-spindle Heald boring machines as shown. This close-up gives the detail of the work-holding fixture, the clamping device, and boring bars. Before pistons are clamped, aligning bars are pushed through from the right to assure precise alignment with the boring bars.

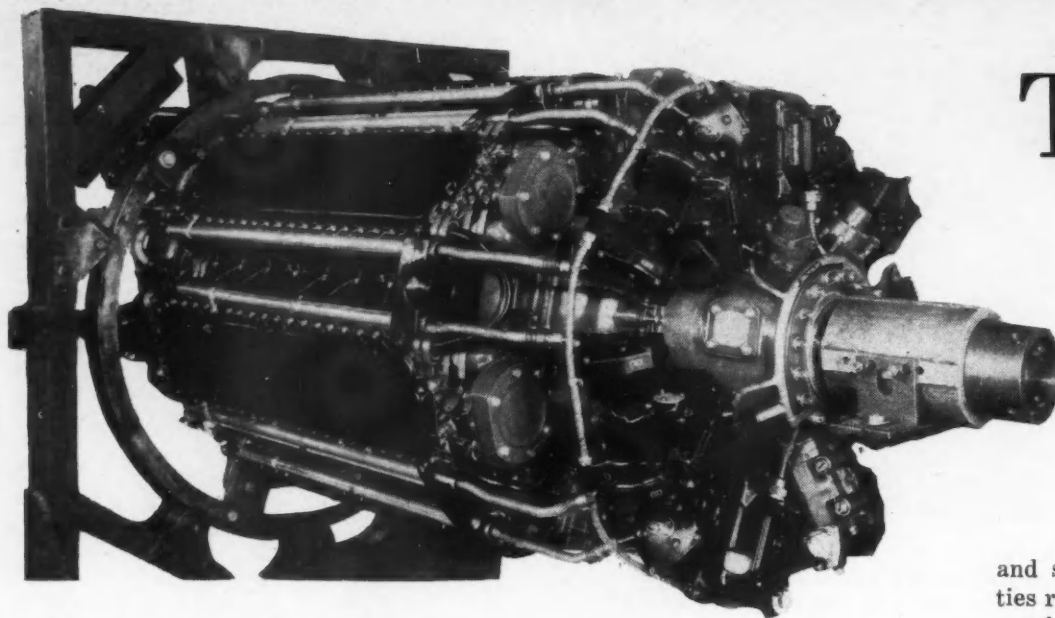


Player Piano Engine Control



THIS pneumatic load and speed control apparatus was designed and built by the Ethyl Laboratories for use in laboratory tests to determine the effect of various operating conditions on engine performance. The apparatus is pneumatically operated on the same principle as a player piano. Engine speed and throttle opening are controlled from a roll of perforated tape which travels across a tracker bar containing 25 holes which are connected to bellows. The entire system is maintained under constant vacuum by a vacuum pump, so that a bellows is actuated when a perforation in the tape uncovers a hole in the bar.

Twenty of the bellows are available for control of engine speed, and, through use of different combinations of the other five bellows, 31 different throttle settings in increments of $3/32$ in. of throttle actuator travel are available for throttle control. Blank tape may be perforated according to any desired pattern, so that the apparatus will adjust the engine throttle opening and the engine speed to match the sequence and duration of engine operating conditions for any type of actual service.



Wright R-2160 engine having 42 cylinders liquid-cooled and an output of 2500 hp

Three

REMARKABLE increases in the power output of aircraft reciprocating engines have been accomplished in recent years through design refinements of existing types and creation of new engines of higher power than had been considered even practical a decade ago. Although the introduction of turbojet and jet-reaction engines to aircraft propulsion seemingly has overshadowed engineering progress on the piston engine, a significant achievement in the development of higher output engines is the fact that more than three times the original power of one reciprocating engine has been obtained through design improvement.

Apportioning this power improvement to the various detailed refinements is a complex problem and will not be undertaken here. Generally, however, in the case of power increase of a given type, the greatest improvements can be credited to advanced cooling techniques through improved cylinder finning, baffling and heat-transfer methods; the development of water-injection; improved carburetion and fuel vapor distribution; application of direct fuel injection; advances in exhaust manifold design and construction; improved ignition systems; tremendous advances in turbosupercharging techniques and more accurate control of the relationships between engine operation variables. Improvements in fuels also have accounted for a very high percentage of the over-all increase in aircraft engine power.

The increase in power through the design and development of new engines is most directly attributable to increased displacement which, in general, has been accomplished through the use of a larger number of cylinders of normal size rather than increased bore

and stroke. Cooling difficulties resulting from increased numbers of cylinders necessitated the use of four banks arranged in helical fashion to provide a path for cooling

air. Generally, large-size engines have featured liquid cooling with its greater degree of control and dependability.

Long-time aircraft engine goals of one pound-per-horsepower, and one horsepower-per-cubic-inch have been exceeded, reaching a specific weight as low as 0.698 lb/bhp and a specific power as high as 1.683 bhp/cu in. These remarkable developments were a product of research into the many allied fields of reciprocating aircraft engine design and supercharging, higher crankshaft speeds, improved fuels, weight reduction, and improved metallurgy, all combined to create this outstanding progress. This broad research was chiefly the responsibility of the Air Technical Service Command at its laboratories at Wright Field, Dayton, Ohio, and the Aircraft Engine Research Laboratory of the National Advisory Committee for

Aeronautics at Cleveland, Ohio, both of which coordinated the work of more than a dozen private industrial laboratories.

In the field of new engine design the greatest progress has been made in the liquid-cooled type. This design was virtually abandoned by the Services as early as 1928 following the Navy's decision to purchase air-cooled radial types exclusively due to corrosion and maintenance difficulties with liquid-cooled types aboard aircraft carriers and at Naval Air Stations adjacent to salt water. The severely curtailed purchases of aircraft engines by the Army at the time forced the Curtiss Aeroplane and Engine Co. and the Packard Motor Car Co., the two largest producers, to abandon the type. Thus, for more than a decade the U. S. was without liquid-cooled aircraft engine production and its accompanying development through applied research at a time when Great Britain, Germany, France and Italy were concentrating their efforts almost exclusively on the type.

By Robert McLarren

Times More Engine Power

Output of Aircraft Piston Engines Greatly Increased Through Design Refinements and New Models

Allison

The Allison Engineering Co., Indianapolis, Ind., which became the Allison Division, General Motors Corp., in 1929, continued the development of the liquid-cooled aircraft engine on an extremely modest and private scale following the Navy's decision in 1928. Allison had produced several versions of the well-known Liberty aircraft engine, including inverted and air-cooled models, following World War I and had produced the large X-4520, a 24-cylinder air-cooled "X" design for the Army Air Service during the Twenties.

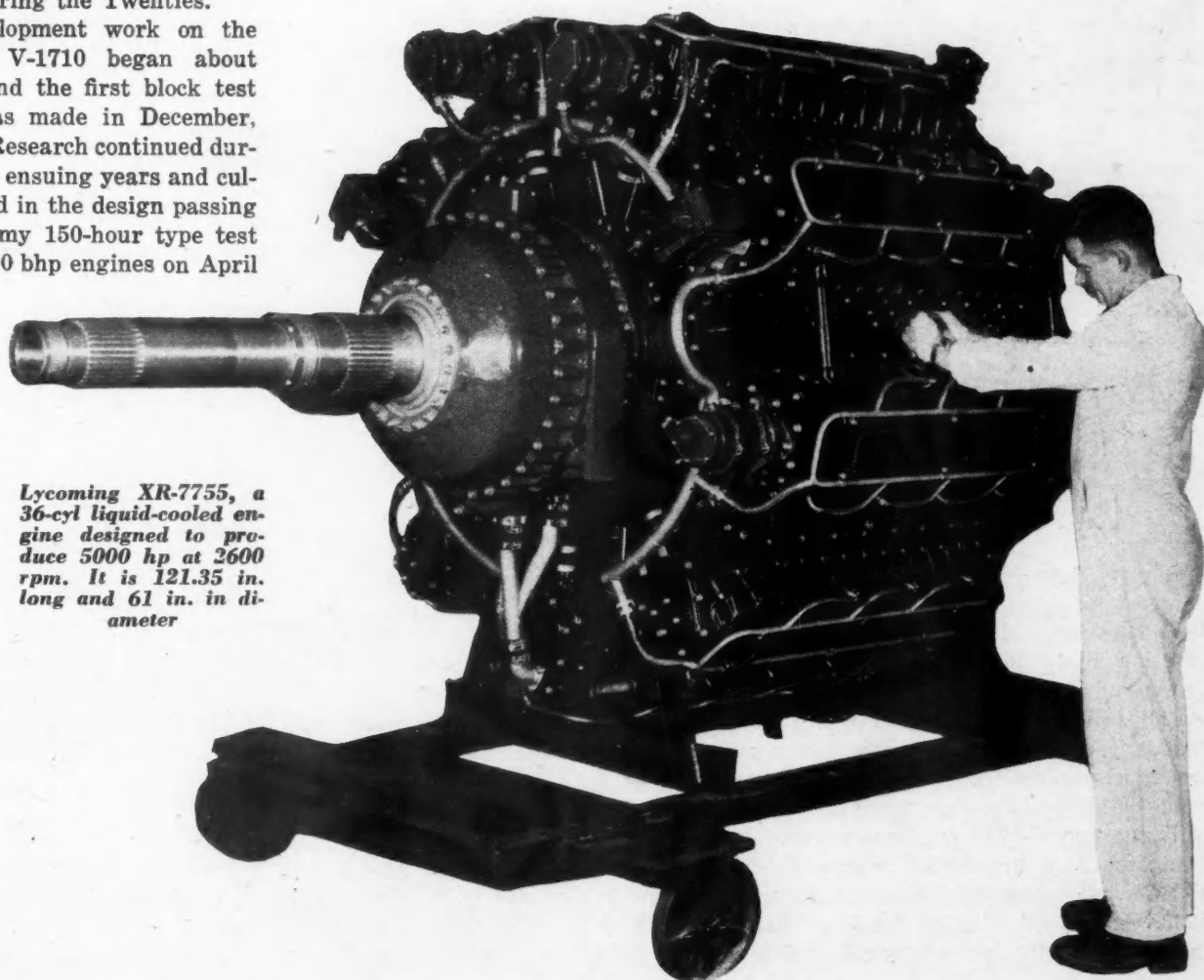
Development work on the famed V-1710 began about 1930 and the first block test run was made in December, 1934. Research continued during the ensuing years and culminated in the design passing the Army 150-hour type test for 1000 bhp engines on April

23, 1937, the first aircraft engine to satisfy these requirements.

When we entered the war, the Allison V-1710 was our only liquid-cooled engine in production and was installed in the Lockheed P-38 Lightning, the Bell P-39 Airacobra and the Curtiss P-40 Warhawk, all of which were in an early form. At the time of Pearl Harbor the Allison V-1710-27 and -29, as installed in the P-38D, delivered 1150 bhp at 2950 rpm. It continued in service throughout the succeeding P-38 and P-39 models as well as the Bell P-63 Kingcobra.

At the close of the war a total of 2800 bhp, utilizing the turbine feedback, was developed by the V-1710, an increase of 180 per cent over the original power output. This produced a specific weight of only 0.709 lb/bhp and a specific power of 1.638 bhp/cu in., certainly an outstanding accomplishment.

The V-1710 was severely criticized in the press and by Congressional committees for its low supercharging and supposedly poor altitude performance in the P-39 and in the early models of the North American



Lycoming XR-7755, a 36-cyl liquid-cooled engine designed to produce 5000 hp at 2600 rpm. It is 121.35 in. long and 61 in. in diameter

American Aircraft Engine Developments

Designation	Manufacturer	Cooling	No. Cyl.	Bore	Stroke	Displacement	Compression Ratio	BMEP	Blower Ratio	Cylinder Materials	Maximum Hp	Rated Power Hp/Rpm/Alt.	Weight lbs.	Specific Weight lbs./hp	Specific Power hp/cu.in.	Power Increase
I-1430	Continental	L	12	5½	5	1426	6.5:1	342	5.93:1	1	2100	1150/3000/25,000	1615	0.769	1.472	91%
V-1650	Packard	L	12	5.4	6	1649	6.0:1	355	8.1:1	Steel	2500	2220/3000/4800	1745	0.698	1.517	81%
V-1710	Allison	L	12	5½	6	1710	6.0:1	347	6.75:1	Steel & Aluminum ²	2800	2800/3200/11,600	1983	0.709	1.638	180%
R-1820	Wright	A	9	6⅞	6⅞	1823	6.7:1	...	7.0:1	Steel & Aluminum	1600	1200/2500/25,000	1308	0.817	0.877	262%
R-1830	P & W	A	14	5½	5½	1828	6.7:1	...	7.15:1	Steel & Aluminum	1350	1100/2600/7500	1550	1.150	0.739	62%
R-2000	P & W	A	14	5¾	5½	2010	6.6:1	...	9.52:1	Steel & Aluminum	1450	1100/2550/7000	1590	1.096	0.718	32%
R-2160	Wright	L	42	4¼	3⅝	2160	7.0:1	...	4.2:1	Steel & Aluminum	2500	2000/2400/25,000	2735	1.092	1.158
I-2220	Chrysler	L	16	5.6	5¼	2220	6.5:1	262	6.46:1	³	2500	2150/3200/25,000	2380	0.952	1.127	150%
H-2470	Lycoming	L	24	5¼	4¾	2468	6.4:1	223	6.15:1	Steel & Aluminum	2300	2000/3100/25,000	2430	1.057	0.971
R-2600	Wright	A	14	6⅞	6⅝	2604	6.85:1	...	10.06:1	Steel & Aluminum	1900	1500/2400/6700	1980	1.042	0.729	27%
R-2800	P & W	A	18	5¾	6	2805	6.75:1	...	6.75:1	Steel & Aluminum	3000	1700/2600/7000	2290	0.784	1.070	88%
R-3350	Wright	A	18	6⅞	6⅝	3348	6.85:1	...	6.41:1	Steel & Aluminum	3400	2000/2400/25,000	2757	0.810	1.016	89%
V-3420	Allison	L	24	5½	6	3420	6.65:1	154	6.9:1	²	3000	3000/3000/30,000	2655	0.884	0.877	50%
R-4090	Wright	A	22	6⅞	6⅝	4092	6.85:1	...	5.0:1	Steel & Aluminum	3000	2400/2600/4500	3230	1.078	0.733
R-4360	P & W	A	28	5¾	6	4362	7.0:1	...	7.52:1	Steel & Aluminum	3500	2500/2550/5000	3490	0.996	0.803	17%
R-7755	Lycoming	L	36	6¾	6¾	7755	8.5:1	196	6.0:1	⁴	5000	4000/2300/40,000	6050	1.211	0.645

I—Inverted
V—Vee
R—Radial

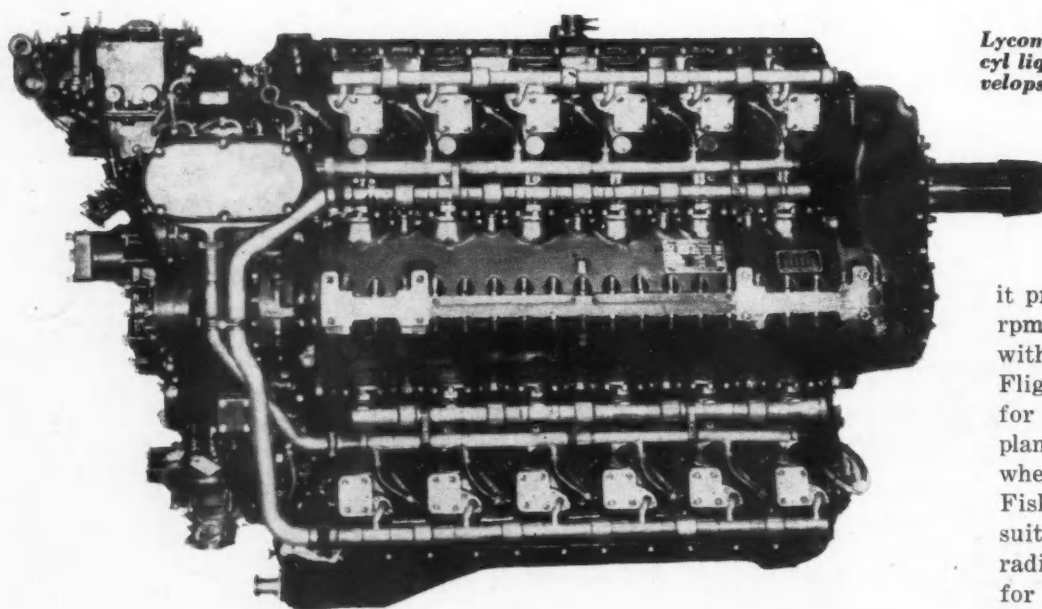
A—Air
L—Liquid

¹—Head: Alcoa 3557-6 cast
Barrel: AMS 6382A forging

²—Stainless steel coolant baffles
Aluminum jacket

³—Head: SAE 4210 cast
Barrel: AMS 6380 forging

⁴—Head: Alcoa 142775 cast
Barrel: AMS 6470 forging



Lycoming H-2470 engine, a 24-cyl liquid-cooled powerplant, develops 2300 hp at 3300 rpm at takeoff

P-51 Mustang. However, its use in the P-38 in conjunction with General Electric turbo-superchargers proved quite satisfactory. Later models of the V-1710, installed in the P-63, had gear-driven blowers and altitude output was considerably increased. It is no longer in production.

In 1937 Allison began the development of a design utilizing two V-1710 engines mounted on a common crankcase in a broad "W" shape. This engine, the V-3420, developed 2000 bhp on its first test run in 1938. It was exhibited at the New York World's Fair in 1939. Development continued during the war until

data on the V-3420 engine recorded. In addition, four of the engines were installed in the Douglas XB-19A, a 70-ton, 212-ft span experimental bomber. Following extensive flight tests of the installation, the giant bomber was retired to the Army Air Forces museum, where it is now on display.

Chrysler

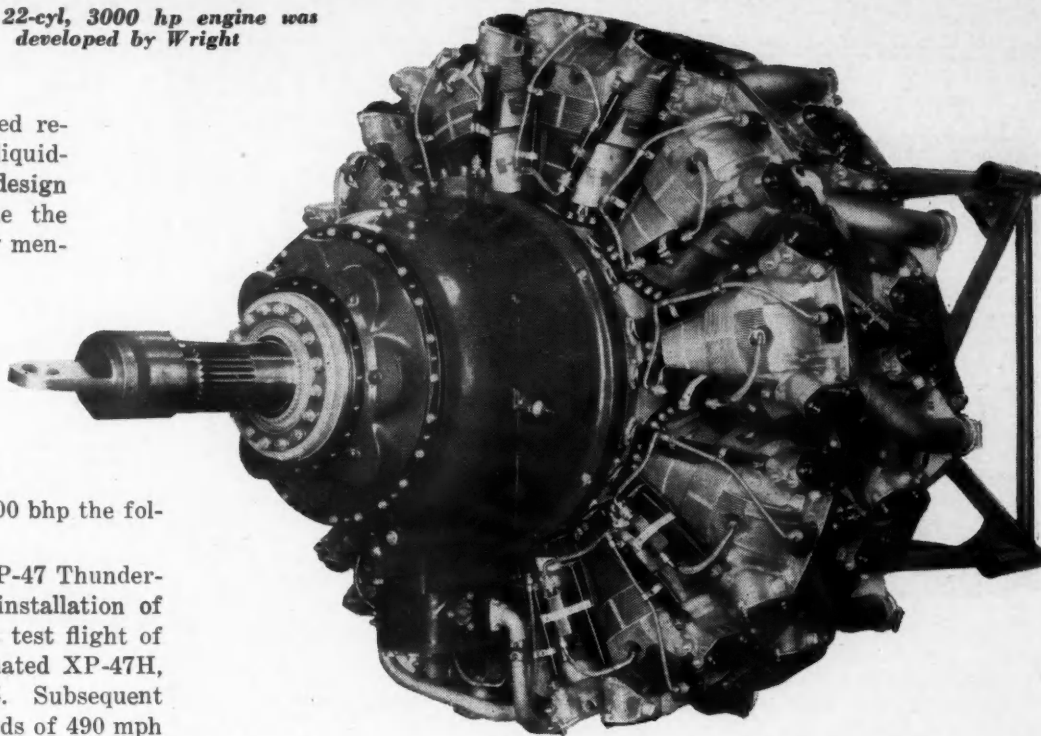
Without previous experience in aircraft engine design, the Chrysler Corp. undertook the design of a 16-cylinder "V" liquid-cooled aircraft engine in May, 1940, at the request of the Army Air Forces as a part

it produced 3000 hp at 3000 rpm at 30,000 ft equipped with turbosupercharger. Flight tests were delayed for lack of a suitable airplane until December, 1943, when it was installed in the Fisher XP-75 Eagle pursuit plane. Although this radical plane was not ordered for quantity production, a total of 12 was completed and considerable flight test

This 22-cyl, 3000 hp engine was developed by Wright

of the latter's accelerated research program in liquid-cooled aircraft engine design established to overcome the "lost decade" previously mentioned. The resulting engine, the I-2220, made its first block test in February, 1940, and delivered 1000 bhp. Subsequent improvement raised this output to 2000 bhp the following year.

A standard Republic P-47 Thunderbolt was modified for installation of the I-2220 and the first test flight of the combination, designated XP-47H, was made in July, 1945. Subsequent test flight produced speeds of 490 mph at altitudes above 30,000 ft. On V-J Day the I-2220 was developing 2500 hp at 3400 rpm, an increase of 150 per cent in output in a period of less than three years. A complete description of the I-2220-11, as fitted to the XP-47H, appeared in *AUTOMOTIVE AND AVIATION INDUSTRIES*, Jan. 15, 1946, issue.



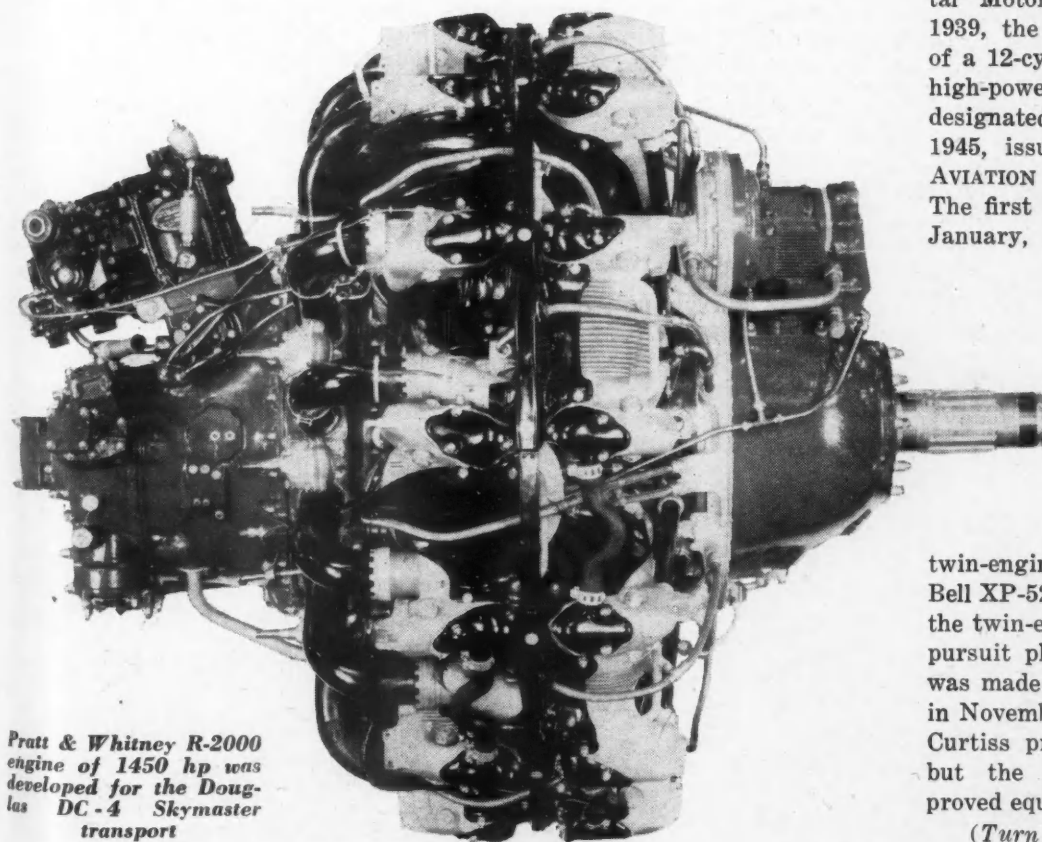
Continental

Continental Aviation Engine Co. of Detroit, Mich., began the design and production of aircraft engines in 1927, and has produced a continuously successful series of light aircraft engines. In 1936 the

firm was reorganized as the Aircraft Engine Division, Continental Motors Corp. In October, 1939, the firm began the design of a 12-cylinder liquid-cooled "V" high-powered aircraft engine designated I-1430 (see May 1, 1945, issue of *AUTOMOTIVE AND AVIATION INDUSTRIES*, page 42). The first block test was made in January, 1941, and produced an output of 1100 bhp. One year later it was producing 1500 bhp and plans went forward for its installation in several experimental aircraft, including the

twin-engine Lockheed XP-49, the Bell XP-52, the Curtiss XP-53 and the twin-engine McDonnell XP-67 pursuit planes. First flight test was made in the Lockheed XP-49 in November, 1942. The Bell and Curtiss projects were abandoned but the McDonnell installation proved equally as successful as the

(Turn to page 62, please)



Pratt & Whitney R-2000 engine of 1450 hp was developed for the Douglas DC-4 Skymaster transport



Sundstrand Model 16 automatic lathe

THE SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., has added a new Model 16 automatic lathe to its present line of lathes. The new lathe is larger in capacity than Sundstrand's present Model 8, 10 and 12 but embodies most of the basic design features.

The lathe is provided with a 75 hp motor. It has a 17 in. swing over slides, and will swing a 21-in. dia chuck. Machines can be furnished in three bed lengths of 36, 60 or 84 in. between centers.

The quick cycle changeover makes it possible to multiple tool this lathe for short runs as well as for production turning. It can be used for either shaft turning jobs or chucking work. The ample horsepower makes it practical to use multiple tooling and carbide cutting tools.

Both the spindle and front carriage drive units are provided with two different driving gear centers. In each case, this feature provides an increased range between high and low spindle speeds and high and low front carriage feeds. In addition, the number of speeds and feeds obtained from one set of gears are both doubled.

Complete control of all cycles is provided by adjustment of dogs on a cycle control disk. Making cams for cycle control is thereby eliminated. Changing position of dogs on disk changes lengths of rapid approach, feed and rapid return strokes.

Pendant control is provided for ease of operation in turning large work. The entire machine cycle is controlled through push buttons. A power operated tailstock is provided. Automatic declutching between spindle and spindle motor with self-adjusting magnetic brake for quick stopping of spindle rotation is also provided.

The rear carriage is adjustable full length between headstock and tailstock centers. Screw feed is provided to the

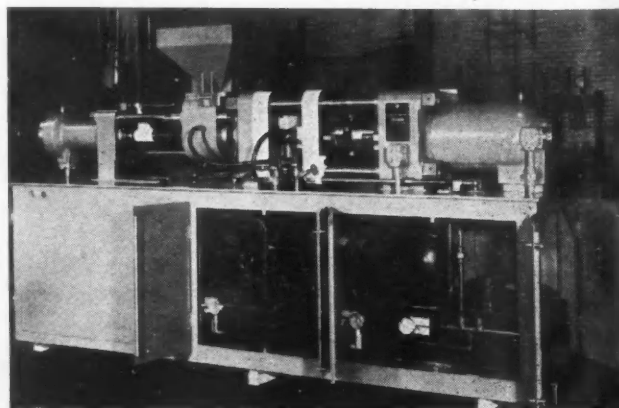
front carriage. The rear carriage and tailstock have rack and pinion adjustment.

PRODUCTION of a newly designed all-hydraulic 4-oz plastics injection machine is announced by the Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio. A number of new design features incorporated in the machine—Model 125-H-4—make it more powerful and faster-acting than its predecessor.

The self-contained hydraulic power system comprises a single gear pump, working in conjunction with a newly-designed Hydro-Power pressure booster, both driven by a direct-connected 15 hp motor. Working pressure of 2250 psi is furnished by the power system, which is unit-mounted in the base of the machine.

A new gravity feed system utilizes a light-weight, windowed sheet steel hopper of 50-lb capacity, which is hinged at its base for access to the feed chamber and for ease of cleaning the entire feed unit. The feed mechanism is self-compensating, automatically providing the correct amount of material at all times.

All-hydraulic, four-oz plastics injection machine manufactured by the Hydraulic Press Manufacturing Co.



Higher mold clamping capacity is provided in the new model. An internal booster ram effects rapid mold closing, while the main double-acting ram supplies live hydraulic pressure up to 125 tons for sealing the mold.

The clamp ram closes at 530 in. per min, opens at 355 in. per min. Forward mold clamp travel is limited by a hydraulic by-pass arrangement, which does away with the need for stop collars on the tie rods.

The injection chamber is provided with a 3-kw multiple-zone heating system, using cast aluminum electric fan heaters and indicating temperature controls.

Larger platen area will accommodate larger molds than heretofore. Vertical mounting between tie rods and utilizing the full vertical platen dimension permits use of molds up to 15½ in. by 21 in. Horizontal mounting gives maximum mold dimensions of 12 in. by 24½ in.

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa., has recently introduced a new gravity drop hammer, the "Ceco-Drop." This air- or steam-operated hammer is designed to operate at approximately 20 per cent more blows than a comparable size board drop. With an air or steam supply of 100 psi, the mean effective pressure within the Ceco-Drop cylinder is such that the upward stroke is accelerated at the speed required to get the additional strokes in a given interval of time.

Ceco-Drop frames are completely new. Each is of a V section with the point of the V shape forming the guides, the sections are lighter at the top than at the base and graduated in between. Ribs, appropriately spaced in the channel of the V, block any vibrating tendency of the planes. The frames are heavier than comparable board hammer frames and have a lower center of gravity. They are Cecolloy castings.

NEW Production and Plant EQUIPMENT

The Cecolloy yoke is mounted on the frames and held by inclined bolts similar to the familiar frame to anvil bolt connection. The yoke is positioned with respect to the frames by wearing plates, located by the tie bolts, abutting the adjacent surfaces. The yoke forms the valve chests and ports to supply pressure fluid to the cylinder, and contains the stuffing box of the piston rod. It also supports the clamp and the clamp operating cylinder.

The Ceco-Drop cylinder is inserted into the yoke. It is equipped with a standard safety cover. Since the Ceco-Drop is a single acting hammer there is no upper port to the cylinder. Rather the top side of the piston is always open to atmosphere.

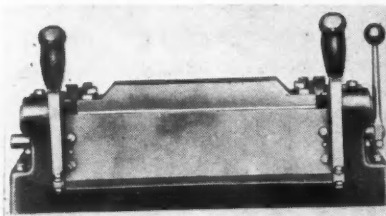
The operating valve of the Ceco-Drop is unique in that it moves in a horizontal plane to achieve more definite positioning. It is a spool type valve and has three positions: One—intake, admitting pressure to the cylinder; two—closed, sealing the cylinder to get advantage of expansion, and; three—exhaust, or opening the cylinder to atmosphere to let the ram drop.

A control valve or throttle valve is included in the supply ports. Its function is to permit the operator to manually control the ram for blocking or unblocking the ram.

The operating control consists of a rocker pivoted on the right hand frame. On the rocker, dogs are mounted, one on the lower arm and two on the upper arm. The dogs, receiving incline actuated movement from the ram appropriately oscillate the rocker. The upper end of the rocker is connected by levers to the operating valve. The first connection is extended into the path of the ram as a safety in case the dogs are not in place. Bearings of the lever system are cushioned against shock by appropriate Neoprene or equal bushings.

The Ceco-Drop will be available in sizes to replace gravity drop hammers ranging from 50 to 5,000 lb, and other drop hammers ranging upward to 20,000 lb falling weight.

THE O'NEIL-IRWIN MANUFACTURING Co., Lake City, Minn., has placed on the market a new line of Di-Acro Brakes for metal-forming work in model shops, experimental laboratories and production departments. The machines are offered in four sizes of forming widths—6, 12, 18, and 24 in., weighing from 45 to 275 lb, respective-



Di-Acro Brake for forming metal

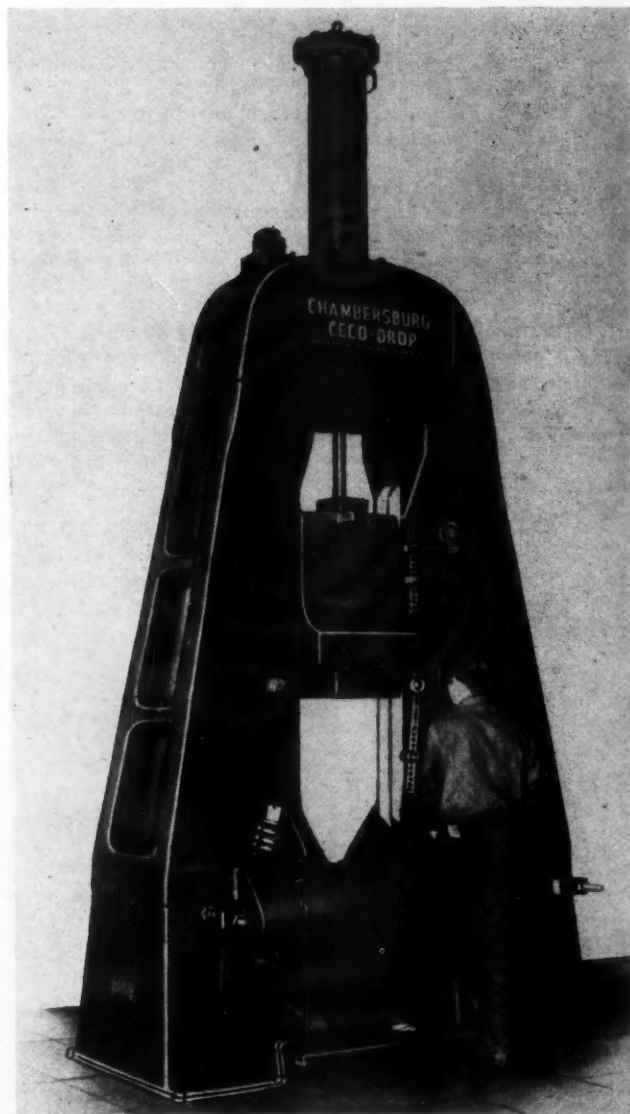
ly. All models have a material capacity of 16 gage cold-rolled sheet steel; and will duplicate parts in such materials as copper, bronze, stainless steel, aluminum, bi-metals, sensitized materials,

varnished cambrics and dielectrics. They are provided with the Rok-Lok, a new material clamping feature which, the manufacturer claims, results in greater accuracy and sharper bends.

Also produced by this company is the Di-Acro Radius Brake for forming chrome-molybdenum and other low ductile alloys which cannot be cold-formed with ordinary types of metal-working brakes. Metallic crystallization is avoided and strains relieved by sufficient distribution of the formed area.

AN IMPROVED automatic segregating instrument for the rapid and accurate inspection of piston rings has been designed and built by the Sheffield Corp., 721 Springfield St., Dayton, Ohio. It will automatically check thick-

Ceco-Drop gravity drop hammer





Sheffield instrument for checking piston rings

ness to a tolerance limit of .0005 in. and gap width to a tolerance of .007 in. or .010 in., and segregate rings at a rate of 2,400 per hour.

After the instrument has been set up, using piston rings of known minimum and maximum dimensions as masters, the operator places the rings to be inspected in the three-finger stack holder with the gaps arranged so that they fit the rail on the back finger. This insures all rings passing through the various gaging stations in the same manner and by pressing the start button they are automatically fed into the proper position.

The first gaging station compresses and checks the ring for undersize, oversize and within tolerance width gaps. If the dimension is out of tolerance, the ring is automatically rejected, removed from the gaging slide and placed in a special compartment. When the gap is correct, the rings proceeds to the next station where it is checked for thickness. Should it be either oversize or undersize, the Electrichek gaging head operates mechanisms which automatically open trap doors and the ring passes into either the undersize or oversize compartment.

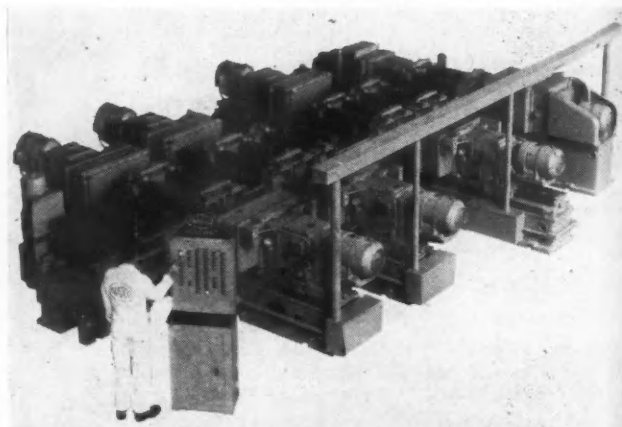
If all dimensions are within tolerance limits, the piston ring proceeds through all the gaging stations and down a chute into a receptacle for accepted units. The parts that have been rejected because of undersize gaps and oversize on thickness can be salvaged and reworked.

THE NATIONAL AUTOMATIC TOOL CO., Inc., Richmond, Ind., has just developed a new automatic processing

machine capable of producing 90 engine blocks per hour. This machine involves 19 stations and is arranged to complete the following operations: drills 23 holes ranging from 3/16 in. to 1/2 in.; combination drills and countersinks one 7/16-in. hole; countersinks 14 holes ranging from 3/17 in. to 1/2 in.; taps 15 holes ranging from 3/8 in. to 7/16 in. tap; drills 19/32 in. diameter oil gallery hole clear through engine block in 12 successive steps; taps oil gallery both ends 3/8-in. pipe tap.

In completing these operations this new machine provides automatic control necessitating one operator. It automatically advances the engine blocks from station to station, clamps and unclamps them in each position, and synchronously performs the operations at all stations as the blocks travel through the Holeway machine. The blocks are then automatically ejected

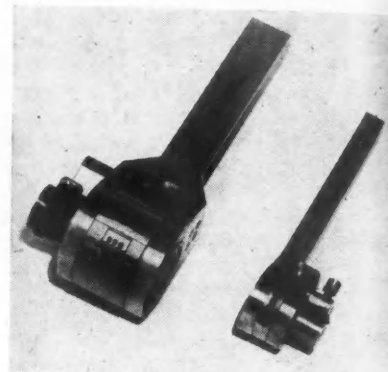
Holeway processing machine



onto a roller conveyor at the completion of all operations.

DESIGNED for use in lathes, shapers, automatic screw machines, etc., a new automatic roll marker for imprinting letters, numbers, calibration lines, serrations, etc., on finish-machined metal parts is available from New Method Steel Stamps, Inc., 147 Jos. Campau, Detroit, 7, Mich. One of the features of this roll marker is its interchangeability for right or left handed operation, as desired. Other features include use of pre-lubricated sealed-in ball bearings for the roller die shaft.

With the "changeover" arrangement, the adjustable stop, stop-dog, and the fully enclosed automatic spring, return can be shifted as an assembly from one side of the marker to the other to suit position in relation to spindle rotation. The marker is also equipped with a device for adjusting the tension of the automatic spring return for the roll.



New method automatic roll markers

The new markers are available with rolls of either solid or interchangeable type. The tools are standardized as to general design, shanks being designed for mounting in conventional holders, but are custom made to meet specific dimensional requirements. Although designed primarily for use on automatic screw machines where large quantities of parts must receive identical markings, this automatic roll marker can



*Taylor-Winfield
new side-mounted
type ENB Style 4
spot-welder with
controls*

also be adapted for use on lathes, shapers, and other similar machine tools.

Now available to the industry is a new air-operated press welder manufactured by the Taylor-Winfield Corp., Warren, Ohio. This welder, Type 1 which is either a projection welder or a combination projection and spot welder when horns are used; and Style 4 which is a spot welder with a swiveling lower horn. The main frame of the Type ENB welder is of reinforced welded steel construction with the welding head support and lower knee mounted on two full-length machined pads. The cast semi-steel head support is horizontally keyed and bolted to, and insulated from, the upper portion of the frame pads. The base of the welder is drilled for foundation bolts. Provisions are made for lifting lugs on top of the welder frame. A hydraulic jack is furnished to raise and lower the knee. Adjustable water valves are furnished to control the water flow through the transformer and electrodes; and a water drain permits inspecting the flow of cooling water. All models are equipped with a roller anti-friction welding head and a bellows air lock. Adjustable-retractable stroke air-cylinders are available if desired.

THE TURMATIC Model GCS is a new "Red Ring" Gear shaving machine which has been engineered by the Na-

tional Broach & Machine Co., 5600 St. Jean Ave., Detroit, Mich., especially for high production operations. This machine has two cutting stations and four work stations instead of the usual one cutting and one work station. Several new automatic features have been added and like all "Red Ring" shaving machines it incorporates the principle of crossed axes shaving.

A central four-sided turret is equipped with four sets of head and tail-

stocks to carry work gears with their axes vertical. Two cutter heads spaced 90 deg apart automatically move the shaving cutters simultaneously into mesh with their respective work gears on adjacent turret faces. These cutters traverse across the work gear faces similar to present "Red Ring" shavers. After completing the cutting cycle, the cutter heads automatically back out of mesh and the turret indexes 180 deg to present two fresh gears to the cutters. Actions of both turret and cutter heads are fully automatic as long as each work station is properly loaded with a gear of the proper size. Thus, at any one time, two turret stations are free for unloading and loading, while the work on the two remaining stations is being shaved.

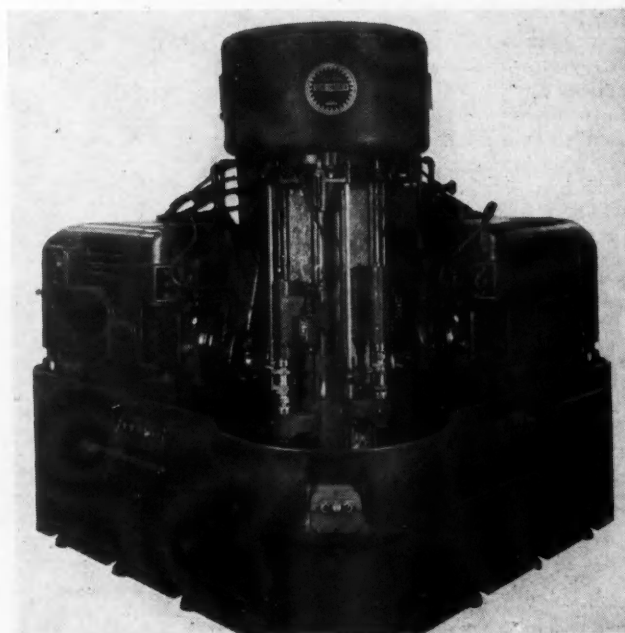
Automatic meshing of the cutter and work gear is made possible by a cutter locator and a nose piece which positions the gear teeth when loading. This nose piece also serves to reject oversize gears.

Both head and tailstocks employ integral tooling or 60 deg center points. Thus the loading of separate arbors becomes unnecessary.

The setting of the two cutter heads is mutually independent. In the case of cluster gears, both cutters may be set to shave similar gears of the cluster simultaneously, or they may be set to shave two different gears, whichever is most desirable.

The system of interlocks and safety devices has been so developed that damage to cutters from oversize or improperly positioned work gears has been eliminated. In any such case, the machine automatically stops until the hazard is removed. Safety lights furnish a constant warning to the operator that the machine is in operation.

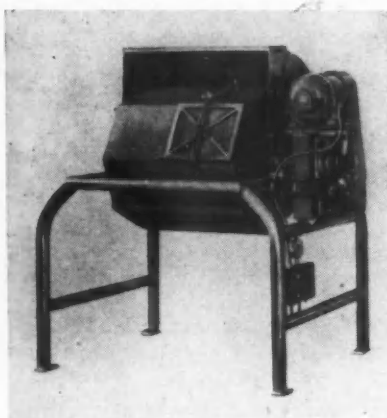
Gears can be crown shaved on this machine and the amount of crown can be varied by cam adjustment.



*Red Wing Model
GCS Turmatic gear
shaving machine*

No special cutters are required; in fact, the same cutters used on other "red Ring" machines are equally effective on the Turmatic.

A LINE of eleven octagonal deburring and finishing barrels of 30 in. diam and 32 to 60 in. length is announced by Almco, Inc., 231 E. Clark St., Albert Lea, Minn. Design features include four-speed drive, quick-clamp doors and welded steel construction throughout. The barrels are furnished either unlined or with full neoprene lining. They are motor-driven at 10, 15, 20 or 30 rpm, (approximately), through a speed reducer and four-step V-belt pulleys—a lever-operated belt release mechanism permitting quick selection of the desired speed. To facilitate positioning of the barrel for loading and unloading, rotation in both directions is controlled by a start-stop



Almco octagonal deburring and finishing barrel

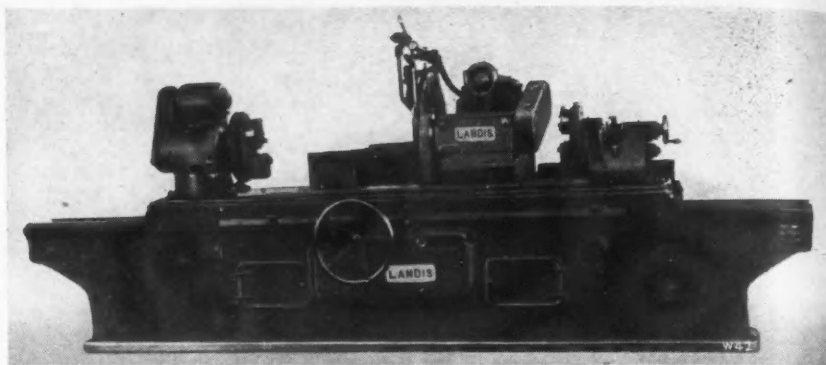
lever which applies a hydraulic brake when in the stop position.

The compartment doors are light in weight, 21-25 lb for a 16 in. compartment; and are opened and closed by a quick-acting toggle clamp. The clamping lever permits the door to be cracked open for draining before unloading. All doors have a water-tight sponge rubber seal, with a take-up adjustment to compensate for eventual compression of the seal. For rapid and complete unloading, door openings come within 0.75 in. of the compartment end walls. All Almco barrels are mounted in a welded tubular steel frame, giving free access to the doors for loading. To permit unloading directly into a work pan or onto a screen, there is 28 in. clearance beneath the barrel. The barrel itself has an approved guard rail and pull-down safety hood; and the driving mechanism is enclosed to meet safety requirements.

HAMMOND MACHINERY BUILDERS, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich., has placed on the market a new chip breaker and diamond finishing grinder, the Model CB-77.

The chip breaker side provides the

Landis Crankshaft Regrinder

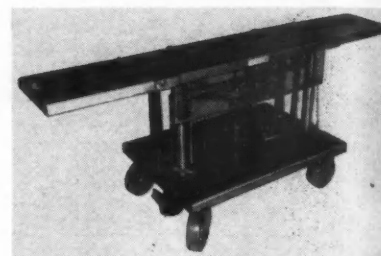


Landis Tool Co., 6 and Ringold Sts., Waynesboro, Pa., has added an 18-in. by 42-in. and an 18-in. by 30-in. crankshaft regrinder to its present line of five sizes. All sizes feature: Microsphere wheel spindle bearings; dynamic balancing of rotating parts; variable voltage headstock drive; micrometer wheel feed for accurate sizing; two-speed hand traverse; and equipment to permit plain cylindrical, taper face or internal grinding. Hydraulic power traverse is available.

necessary movements and angular settings required for chip breaker grinding. The movements are: vertical with handwheel and dial calibrated to .001 in. traverse in and out from wheel with handwheel and dial calibrated to .001 in. and reciprocation underneath wheel with a lever operated table traveling on ball bearing ways. An Any-Angle vise provides all the necessary angular settings with four swivels, each of which is graduated in degrees. These swivels are numbered from 1 to 4 for easy identification and are: No. 1 top swivel for side cutting edge angle, No. 2 and 3 swivels for back and side rake angles and No. 4 bottom swivel for chip breaker groove angle. An instruction plate on the vise makes clear the purpose of each swivel and the settings.

The cup wheel side accommodates either 6 in. or 7 in. diameter cup wheels. The table tilts to any point between 25 deg above to 30 deg below

horizontal by unloading a lever. The table assembly is moved in and out from the wheel by a feed screw. It is equipped with a compound protractor gauge. This gauge slides in the table slot parallel to the cup wheel and also has a cross slide for moving the gauge face in toward the wheel.

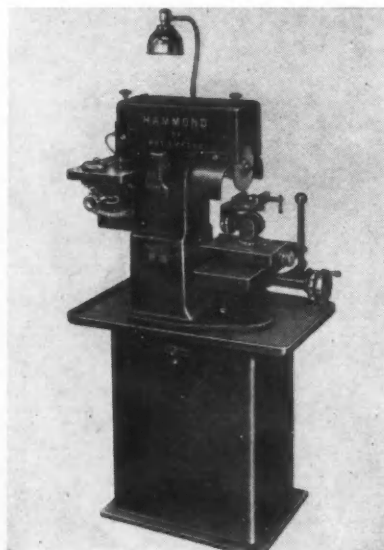


Rack hydraulic feed table conveyor

RACK ENGINEERING Co., Pittsburgh, Pa., has just placed an improved hydraulic feed table conveyor into production.

The table is made in capacity sizes ranging from one to five tons, and is capable of handling sheets from three to ten ft in length. The foot-operated hydraulic operated mechanism permits the operator to raise or lower the load to precise levels and to control the angle of the table top through its range of 40 deg. When tilted to working position, the top is secured by tilt locking pins at both ends of the table. The operator's hands are free to transfer sheets from the table top into the die set.

Equipped with six in. roller bearing casters, two of which are swivel type, the table is said to be easily maneuvered about the plant floor when loaded to capacity. A heavy duty floor lock insures stability when the unit is in working position. A guard screen attached to the table top affords maximum protection for the operator in all positions of lift and angle of the table top.



Hammond Model CB-77 combination chip breaker and diamond finishing grinder

How Many New Cars and Trucks in 1947?

(Continued from page 17)

On the parts outlook, eight passenger car companies were checked with these interesting results:

Half of the companies state parts sales are continuing to climb, while the other half indicate volume continuing evenly at peak levels. A higher level of back orders is reported by three companies, while four companies indicated somewhat lower levels—one firm experienced no change.

Four companies reported higher dealer parts inventories, two the same, one lower, and one uncertain. However, considering sales volume, none considered inventories high, although they are watching them carefully. There is divided opinion as to parts production volume this year, but a majority believe it will approximate, if not exceed, 1946 output. Volume in 1946 was more than double the prewar peak in 1941, which was 30 per cent above any previous year. The current tremendous demand for replacement parts significantly reflects user judgment as to the vital essentiality of cars and trucks in America today.

When pushed too hard, sheet mills and blast furnaces break down, just like old cars, trains and airplanes. Experienced operators say that, because of this, results should be estimated at from 5 per cent to 10 per cent below schedules.

The 1947 production estimates by steel and automobile executives consulted varied from 3,600,000 to 5,250,000. Significantly, only figures from steel sources were below 4,000,000.

Excluding the strike factor, my own estimate is that 3,600,000 cars and 1,100,000 trucks and buses, or a total of 4,700,000 American motor vehicles will be made in 1947. This compares with a total of 3,100,000 last year and 4,800,000 in 1941.

But car dealers in the United States will not get 4,700,000 vehicles because, as in previous years, some vehicles will be exported. Surely it is unnecessary to establish the importance of maintaining export outlets on a stand-by basis, particularly when our dependence on raw material imports is so great. Last year 6.7 per cent, or 144,000 cars, were manufactured for export and 20 per cent, or 186,000 trucks. Despite the absence of truck export controls and the expiration of similar car controls on March 31, these proportions are not expected to change materially during 1947.

Therefore, my specific answer is, we will get 4,250,000 cars, trucks and buses in 1947, barring crippling strikes.

Will strikes aggravate materials shortages or stop car production this year? Even the present strike lull does not justify us in ignoring this as an important outlook factor. The recent improvement would seem to be the best evidence of the obligation Congress has

to reflect in Government policy and national law the public indignation expressed at the polls last fall. CIO control over its union subsidiaries and their control over the workers is disclosed by the abrupt termination of strikes when it was reported that Phil Murray "had asked all CIO unions 'to go slow' on new contract demands to 'reassure' the public and 'promote real collective bargaining.'" Even the so-called "spontaneous" wildcat strikes which crippled armament output when our nation's future was imperiled have ceased now that Congress threatens to curb unlimited union power.

Nevertheless, our present relative freedom from strikes is a great blessing for which every American—in fact the whole world—should be thankful. This world-wide boon is so important that we should not fail to ascertain its source. Primarily, it comes from an aroused public opinion. Secondly, the source is a Congress and President who are searching for ways to implement their ballot mandate to enact fair and honest laws that are neither pro-labor nor pro-management, but pro-public.

We can expect good union conduct until Congress acts. What happens then will depend on whether Congress has done the thorough job the voters demanded.

Another important development which

was reflected at the polls and elsewhere is growing support among consumers, including union members, for price reductions rather than further wage increases at this time. In other words, less union membership support for production strikes, but more support for buyers' strikes.

Last year, steel, coal and other strikes cost us 1,400,000 vehicles. As costly as the big strikes were, the hundreds of strikes in small companies, resulting from arbitrary application to such companies of the wage and contract patterns worked out with big industries and big companies, were just as disrupting.

Gentlemen, to put it bluntly, what Congress appears disposed to enact will not remove or control the monopoly power which John L. Lewis, and the scores of union leaders who seek to emulate him, have used to accomplish past aims which proved contrary to the public interest. Under these circumstances, the extent to which strikes will aggravate material shortages and stop car production can only be answered by Lewis, Murray and Reuther, unless more people insist that Congress keep right after the job until the fundamentals have been dealt with. Congressional vigilance must not be permitted to wane as long as powerful union leaders, or any other private citizen or group, can throttle our national economy at will.—From an address before the National Automobile Dealers Association.

Unique Engine Assembly System

(Continued from page 25)

the parts necessary for building an engine directly at hand, and automatically takes care of the specifications of the particular engine.

Kits are made up in the stock room according to the building schedule, the stock room being traversed by an overhead rail on which the racks are moved at will. The first step in making up the kit is to round up all of the parts necessary to fill the customer's order. If more than one engine is covered by the order, the stock room attendants pick off the total number of parts required for the entire order. Later this is broken down into individual sets, one per engine. Completed kits, assembled in racks, then are moved out of the stock room and headed for the final assembly. As the racks reach the assembly line they are transferred to the mechanized rail conveyor according to the building schedule for the day.

This method has important advantages aside from facilitating the assembly operation. It eliminates the usual storage bays and bins required for parts and fastenings customarily arranged along the assembly conveyor. More important, however, is the fact that shortages are noted while filling kits in the stock room long before the engine is scheduled for the line. If

shortages are serious enough to delay the building of an engine, it is possible to start a follow-up without delay and at the same time modify the scheduling of the line. By this process, shortages are found quickly and the line is kept moving productively by scheduling only those engines that have complete kits at the time.

Piston Tooling Innovations

(Continued from page 34)

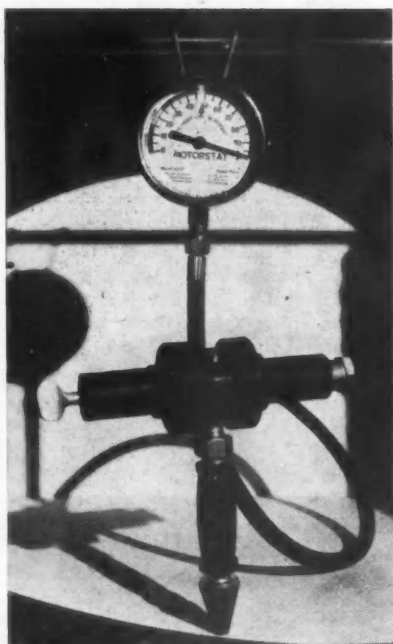
ing bar goes through for sizing. Bores are checked and graded for size by means of Pratt and Whitney Air-O-Limit gages.

The Zollner practice of serrating entire skirts for certain types of heavy duty pistons, such as are used in Cummins diesel engines, for example, is done before cam-grinding on a new LeBlond lathe fitted with an hydraulically operated floating attachment having two serration tools mounted one over the other. Following serrating, the pistons are cam-ground to size, then tin-plated. Cam-grinding removes all sharp edges and finishes the skirt to shape and size. The plating which fills the entire serrated area is done to attain long-lived operation without scuffing.

Volumatic Printer-Developer for High-Speed Production

The new Bruning Model 91 BW Volumatic printer-developer, manufactured by the Charles Bruning Co., 4754 Montrose Ave., Chicago, Ill., is said to incorporate design features which speed and facilitate the production of prints. It is intended for large-volume production of cut sheets; and accommodates roll stock up to 42 in. wide. It prints and develops all Bruning BW mediums, including light, regular or card-weight BW paper prints with black or colored lines on white backgrounds; black or colored line paper prints on green-tinted backgrounds; transparent paper prints; cloth or film prints. These prints are produced in volume at speeds up to 30 fpm, the manufacturer states.

Gage for Testing Engine Condition



A new product of the Griswold Manufacturing Co., 305 W. Lancaster Ave., Wayne, Pa., is this Motorstat engine condition testing gage. It consists of a pressure gage, regulating screw, neophrene adapter and operating valve, and connection for an air hose. By introducing a constant quantity of air under pressure into an engine cylinder with valves closed, any leakage in the cylinder is recorded on a dial gage graduated in per cent of cylinder loss. It can be used to determine leaking valves, piston ring leakage, leaking cylinder-head gasket, loose cylinder-head studs, and leaking fuel injector.

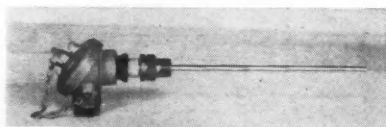


Bruning Model 91 printer-developer

The new model is equipped with an extra-large feed board, providing more than 13 sq ft of space. Sensitized medium and original copy are drawn into the machine by a new vacuum feed, and are held in close contact with each other as they are conveyed to the light source. In roll stock production, the stock is drawn over a ball-bearing mounted stainless steel roller. An "on-and-off" push button controls all electric motors and heaters, starting or stopping the entire mechanism. A speed-control knob and calibrated dial enable the operator to change to any printing speed within the range of the machine; and a light-shield control knob permits the reduction of light exposure up to 50 per cent. Pressure on a foot pedal releases tension on contact bands instantly to re-align incorrectly fed roll stock. Light is provided by a stationary 75-watt per in. mercury-arc light, mounted within the revolving Pyrex cylinder. A cooling system is furnished. For producing photographic prints, a Copyflex fluorescent lamp can be installed.

Original copy and sensitized medium are removed from the cylinder after exposure by an air stream. A tracing and print separator provides automatic separation of original copy from the sensitized medium. Suction is applied to the sensitized medium while, at the same time, an air stream separates the original copy from it. This separator eliminates the necessity for exact register when feeding prints.

It is claimed that the new Volumatic assures uniformly developed prints at all speeds. The developed print is exposed to the operator's view before it enters the drying unit, thus permitting the operator to correct light intensity

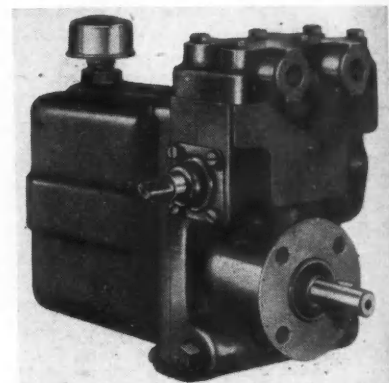


L&N industrial Thermohm

before exposing the next print. After development, finished prints are delivered to a stacking tray at the rear of the machine. A simple adjustment of the tray permits prints produced on roll stock to be directed to a trimming table. Since the machine requires no plumbing or venting, it can be installed anywhere in a drafting room or engineering department.

New Hydraulic Power Unit

A new hydraulic unit, the Power Pack, manufactured by Vickers, Inc., 1428 Oakman Blvd., Detroit 32, Mich., combines several of Vickers basic products in one self-contained unit. It is composed of a vane pump, relief valve, various combinations of single and double operating valves, an oil filter, air cleaner and oil tank. The unit weighs 45 lb. and can be attached directly to any power drive with V-belt, chain drive, or gears. Available with



Vickers hydraulic Power Pack

nominal pump delivery of 2, 3, or 5 gpm at 1200 rpm and 1000 psi, the Power Pack develops hydraulic pressure to lift, lower, push, pull, stack, load and hold any load, depending on the cylinder size used. It is used for power operation of farm implements, road construction and maintenance equipment, industrial machinery, and materials handling equipment.

Fast-Acting Thermohm

A new type of industrial Thermohm introduced by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa., extends the range of L&N resistance thermometer recorders and controllers to temperatures as high as 1000 F.

This Thermohm is said to be amply accurate for the more exacting industrial requirements. Speed of response is much faster than that of usual heavy-gauge couplers and is matched only by small pipe-type or fine wire couplers.

Its own corrosion-resisting stainless tube gives protection for normal pres-

NEW Products

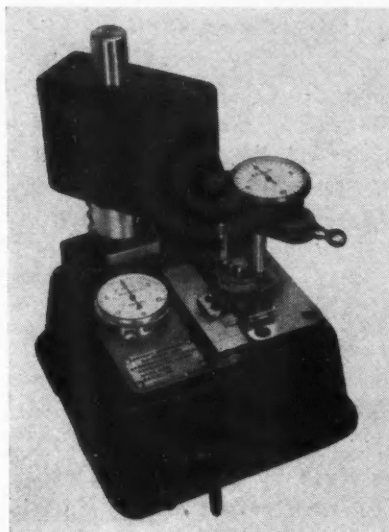
tures and non-corrosive fluids. Like any thermocouple or thermometer bulb, the Thermohm can be used with protecting wells where required. The temperature coil is protected against contamination by moisture or gases.

The new Thermohm is equipped with the standard universal head that facilitates installation and connection. Standard lengths are six and 12 in.

New Gage Introduced by Bryant Chucking Grinder Co.

Bryant Chucking Grinder Co., Springfield, Vt., has brought out a new gage for checking the important relationships between the pitch diameter of a thread and the face of the part. This new Squareness-of-face gage may be mounted on any Bryant thread gage. The face gage consists of a movable arm which carries a large dial indicator and two contact points which are adjustable to cover the capacity of the thread gage. The inner contact serves as a pilot and compensates for thread progression as the part is turned for inspection. The front contact actuates the dial indicator on the face gage.

Operation of the gage is as follows: The control lever withdraws the thread segments behind guides; the part is positioned and the three thread segments are engaged; the part is given one-third of a turn for all-over thread inspection, which is recorded visually on the thread gage dial indicator. Next the squareness-of-face gage is swung into position and a half turn more



Bryant Squareness-of-face gage

checks the right angularity which is recorded visually on the other dial indicator. The control lever is then actuated, allowing the part to be lifted from the gage, thus eliminating unscrewing the part off the thread segments. No "feel" is necessary for inspecting the threads or their squareness to the face.

Each Squareness-of-Face gage is furnished with a master setting ring with one face ground square. Various models cover capacities from $\frac{3}{8}$ in. to 8 in.

Protective Apron Made of Plastic

The West Disinfecting Co., 42-16 West St., Long Island City 1, N. Y., has placed on the market a plastic apron, the Durma-Gard, made of polyvinyl chloride-acetate, for protection against acids, alkalis, grease, oils and other occupational hazards. It weighs 10 oz. and is easily washable with soap and water. There are no cloth stitches in the apron, as heat-sealed seams are used. Specially reinforced stress points, the manufacturer states, add to its durable construction. A safety feature of the apron is a trough designed to catch drippings which would otherwise fall on shoes and clothing.

Hydraulically Operated Fifth-Wheel Attachment

Announcement of an hydraulically operated fifth-wheel attachment for truck-trailer use has been made by Pollard Co., 14571 Schaefer Highway, Detroit 27, Mich. The device is recommended primarily for yard switching,

although it can be lowered to any suitable height for use in local delivery service. It is said to have been thoroughly tested in actual service by a large mid-western freight hauler for yard freight dispatching.

The device is installed in conjunction with a standard fifth-wheel and is arranged to elevate the front wheel dollies of a semi-trailer sufficiently to permit movement of the trailer either in the elevated position or with landing gear in the vertical parking position. This is done by means of an hydraulic hoist installed forward of the rear axle and controlled by two levers in the truck cab. Another feature of the attachment is a fifth-wheel lock release. The lock arm is released by means of an arm and chain operated by a vacuum cylinder from a dash control.

With this attachment, the fifth wheel is mounted lower than customary, thus



Hydraulically operated fifth-wheel attachment for truck-trailer use.

permitting it to slip readily under the front end of a trailer. This makes it unnecessary to force the tractor under the trailer, a practice said to be detrimental to the life of running gear. When used for switching about the yard, the trailer deck is inclined about five degrees. This is claimed to be an advantage in unloading the trailer.

New Line of Stainless Steel Electrodes

A complete line of stainless steel electrodes in a full range of grades and diameters has been announced by Air Reduction Sales Co., 60 E. 42 St., New York 17, N. Y. All electrodes are furnished with a heavy extruded lime type coating for direct current application; and all except the straight chrome analyses are obtainable with a lime-titania type coating usable on alternating or direct current. The slag produced by either of these coatings is easily removed. Electrodes with the lime-titania type coating are said to offer many desirable features not found in the lime type coated electrodes. (Turn to page 60, please)

Automatic Inspection System



This automatic inspection system for small parts, developed by the Arma Corp., Brooklyn, N. Y., is an electronic light-indicating comparator for automatic classification of parts up to 1.5 in. sphere maximum size. The equipment inspects, counts and sorts parts, and places them in good or rejected groups.

NEWS *of the* Industry

Automotive Manufacturers Show Satisfactory Earnings

Financial reports from automotive manufacturers indicate that the industry is doing very well financially at present. GM recently restored the dividend on its common stock to \$.75 a share, an increase of \$.25 from the amount for the three previous quarters. Packard announced a dividend of \$.15 a share in February, the first one in two years. George T. Christopher, Packard president, said the dividend would be paid out of earned surplus. In the first quarter of its fiscal year, Nash reported a profit of \$4.1 million as against a loss of \$638,857 in the same quarter of the previous year.

Automotive Production Threatened by Controls

In an attack on Government allocation of pig iron to the housing industry, George W. Mason, president of AMA, has told the OTC that the diversion is likely to cause reduction in automobile and truck production schedules within the next month or two. He charged that allocation of pig iron to the housing industry exceeds any realistic possibility for new home construction. While the diversion to housing undoubtedly is an important factor, it also is true that production difficulties in the foundries are limiting the supply of pig iron. An important bottleneck is the supply of coke of the required quality. Experienced foundry labor is another limiting factor. The pig iron and castings shortages have been threatening for some time to become a major bottleneck and industry spokesmen predict that it may replace steel as the No. 1 critical item some time this summer.

A statement by T. J. Ault of Warner Gear Div. of Borg-Warner indicates how seriously the diversion of pig iron to other industry can affect automotive production. He stated that discriminatory allocation of pig iron by OTC for the first quarter of 1947 is diverting 50 per cent of total pig iron production to the Southern stove and cast pipe industries which represents only 8 per cent of pig iron users. Republic Steel, one of the largest producers of pig iron, reports that 87 per cent of its production has been ordered diverted to this one small segment of industry. The immediate results, he said, will be curtailment of production and shutdowns in Warner Gear's foundry sources, thereby drastically reduc-

Industry Doing Well Financially . . . Pig Iron Diversion Likely to Cut Car Production . . . 1947 Output May Fall Short of Four Million Cars . . . Rumors of Strange Steel Offers in Detroit . . . Financial Difficulties of UAW-CIO . . . Tucker Car Scheduled for June Production . . . Ford Increases Steel-Making Facilities . . . Lead Scarcity Still Restricts Output of Batteries . . . Station Wagon Bodies to be Built by Fisher . . . 1948 Chrysler Imperial to Have Vacuum Brake Booster . . . Helicopter Rights Bought by Glenn L. Martin.

ing and restricting production and employment of more than four thousand workers at the Warner Gear Div. alone.

Major automobile companies in Detroit are worried over the pig iron situation and many are wondering what is becoming of the excessive allocations of pig iron to other industries, such as mentioned by Mr. Ault. There is considerable suspicion that it is finding its way into black market channels and being resold at exorbitant prices. The industry is bringing increasing pressure to bear in Washington to bring allocations more in line with a realistic level of need.

Doubt Now Clouding Estimate Of 4 Million New Cars in '47

At the outset of the year, predictions heard in the automotive industry were that 4 million cars and 1.2 million trucks would be built during 1947. Recently there have been some signs of doubt in some quarters that this goal will be attained. George Romney, General Manager of AMA, said in mid-February that the outlook is for but 3.6 million cars and 1.1 million trucks. On the other hand, some industry spokesmen still maintain that four million cars is a good guess. It should be noted that by mid-February car and truck production had passed the half million mark. Admittedly production for January was several thousand be-

low that of December but was due primarily to short shutdowns by GM Divisions for inventory taking and model changeover. Bad weather during the month also hampered delivery of parts. Nonetheless, Ford Motor Co. hit a six-year high of 90,023 units in January which was the highest since June, 1941. Kaiser-Frazer nearly doubled its January production over the December output with 7,141 cars. Willys-Overland also hit a new postwar high in January when it broke over the ten thousand mark.

January automotive production at General Motors plants took a sharp drop, due principally to shutdown for inventory taking and model changeover. Output in U. S. and Canadian plants fell from 174,489 in December to 123,152 in January. The down time for the changeover contrasts sharply with prewar practice, when plants would be idle for several weeks. This year it amounted to only ten days to two weeks. However, the changes were almost negligible.

February production in the industry is expected to equal that of January despite the shorter work month and supply difficulties encountered because of extremely bad weather. However, production is expected to pick up somewhat in March and to continue the upward trend until mid-summer, after which supplies are expected to be much easier. During the last half of this year, output should boom along on a very high plane. The one bad possibility at present is the strike at the L. A. Young Spring and Wire Corp., a key supplier of automobile cushion springs. Packard was forced to close a week in mid-February by the strike but indications were that the difficulty would be resolved soon.

Manipulations in Steel Reported Current in Detroit

Reports are floating around Detroit of some interesting high-jinks in the field of sheet steel supply. Several companies are said to have been offered heavy tonnages of scarce sheet at prices from two to three times current market quotations. At least one company has investigated but found that it could not pin down the offer to anything definite. One speculation is that some brokers are gambling on an industrial recession this summer which would enable them to get all the steel they had promised for second and third quarter delivery. However, there seems to be no legitimate steel company that

is making any such offers and apparently it is just another case of attempted manipulation of supply by a handful of opportunists.

UAW-CIO Has Troubles Over Ability to Pay

The UAW-CIO is having a tough time financially in the midst of prosperity. The last official financial report discloses that the Union had spent approximately two million dollars more than it received during the fiscal year ending last May. Net worth declined from \$2,689,353 to \$715,375. Dues paying members dropped to 550,000 in December, 1945, but since has risen to about 800,000. The Union now is able to get along on its income but its reserves have been washed out. In fact, the Union was forced to borrow \$250,000 from another union to protect its bank balance. It also was forced to cash all of its U. S. Government Bonds. The strike fund which is a separate account is in a very sorry shape at present. Donations in November and December averaged less than \$5000 a month and the per capita tax amounts to about \$40,000 a month. However, the present Allis-Chalmers strike is draining heavily on the strike fund and the report states that relief cannot be long continued on that income. At present, a 1947 special strike assessment is being levied and will swell the strike fund reserves. On the basis of the critical financial situation of the Union it is not likely that leaders will be in any hurry to promote large scale strikes this year.

Tucker Plans Production Of New Car Next June

Latest estimate of start of automobile production by Tucker Corp. is next June. Preston Tucker, president, announced in Chicago recently that about 200 cars are scheduled to come off the lines that month. He said that production would increase rapidly thereafter and that goals for July, August, September and October would be 2200, 3400, 6500, and 9000, respectively. He also said that the only optional equipment that will be offered will be a front end assembly of fenders and lights that turns with the front wheels. Conventional type stationary fenders and lights will be standard equipment.

Ford Building New Facilities For Sheet Steel Production

Flat rolled steel tonnage at the Rouge plant of Ford Motor Co. will be increased through erection of a new one-story addition at the south end of the present cold mill building. The new addition, which will be started immediately, will be 440 by 180 ft and will cost \$1.47 million. Although no increase in rolling facilities is planned, output will be increased through im-

proved handling facilities and through less loss caused by the excessive handling and outside storage required under present conditions. It now is necessary to transport hot-rolled coils from the mill to outside storage on rail cars where it is unloaded by cranes. It is then necessary to reload it for pickling and transfer back to the cold mill division. Handling of the annealed coils is said to result in damage to the steel and the outside storage often causes rust and pitting of the cold-rolled surfaces. Production efficiency in the Ford mills should be greatly improved through the more efficient handling made possible by the new facilities.

Battery Shortage Expected To Continue Until Late '47

Because of the continuing shortage of lead, automobile batteries will remain scarce until late this year, according to D. H. Kelly, exec. vice pres. of Electric Auto-Lite Co. He said that if the present forecasts materialize, 250,000 tons more lead will be available this year than the industry got in 1946. He added that price is a considerable factor now, since lead has increased from 8.25 cents a lb. under OPA ceilings to 13.65 cents in the uncontrolled market. Since the average battery takes approximately 22½ lb of lead, the increase for materials alone would amount to more than \$1.

Fisher Body to Build Chevrolet Station Wagon

For the first time in its history, Fisher Body Division of GM will produce station wagon bodies. The project will be carried on at the Cleveland plant which has been engaged in fabricating work since 1936. The station wagon will be produced for Chevrolet only and will be in two styles: one with two seats, accommodating five persons and a large luggage compartment; and the other with three seats for eight passengers. Production is expected to

get started this spring but will be determined somewhat by the availability of materials, principally hardwoods. Ford Motor Co. is particularly fortunate in that respect since it has its own hardwood holdings in northern Michigan which undoubtedly accounts for the fact that Ford last year built more station wagons than all other manufacturers combined.

Brake Booster Developed For Chrysler Imperial Line

It has been confirmed that Kelsey-Hayes Wheel Co. has developed a vacuum brake booster that will be included on the 1948 Chrysler Imperial line. Lincoln Division of Ford Motor Co. also is said to be interested in the development. The booster system is similar to that used on trucks to give greater braking power with less pedal pressure.

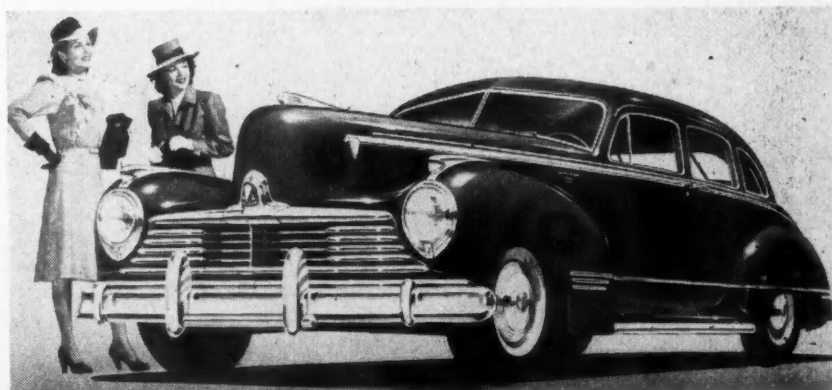
Ford Giving '47 Titles On Current Model Cars

Buyers of new Ford, Mercury and Lincoln passenger cars are receiving 1947 titles to their vehicles although the cars still are the same models as produced in 1946. Ford is using this procedure to protect buyers on valuations in the future when their cars are either sold or traded on new models. The company is planning face-lifted versions to be introduced possibly in late March.

Glenn L. Martin Company Buys Helicopter Patents

Glenn L. Martin Co. has announced that it has purchased assets and patents of Rotawings, Inc., of Philadelphia, helicopter manufacturer. The company says there is no plan for developing a complete helicopter at this time, but that research and experiment with helicopter control systems, rotor hub and blades, and other parts of rotating-wing aircraft will be continued.

1947 Hudson



This new Hudson for 1947 is now on display at dealer showrooms throughout the country. Hudsons are available in the Super Series and the Commodore Series with a choice of 102-hp Super Six and 128-hp Super Eight engines.

PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE and AVIATION INDUSTRIES. In making requests please be sure to give the NUMBER and TITLE above the item concerning the publication desired, your name and address, company connection and title.

48—Flexible Shafting

Walker-Turner Co., Inc.—A new 20-page Engineering Data Bulletin on flexible shafting design covers applications in aircraft instruments, radio, appliances, industrial machinery and other special uses. The bulletin describes construction and characteristics and includes engineering formulas and tables to aid in proper selection.

49—Standard Drawing and Drafting Room Practice

American Standards Association—A revised edition of the book, American Standard Drawing and Drafting Room Practice has been issued. Copies are available at \$1.50 per copy from the above association at 70 East 45th Street, New York 17.

50—Fitting Shape Chart

The Parker Appliance Co.—Bulletin No. T37 contains small sketches of AN, AC810, AC811 and NAF fittings, grouped by types. Each type is described and tables on interchangeability, identification and thread sizes are given. Also included are explanations of fitting shape, material and weight symbols as well as data on specification of regular and reducing sizes.

51—Simplex Util-A-Tool

Templeton, Kenly & Company—A new descriptive bulletin tells in detail the various uses of the Util-A-Tool. Specifications charts and price listings are included.

52—Insulating Varnishes

General Electric Co., Chemical Dept., Resin and Insulation Materials Div.—A 40-page booklet containing complete technical and application data on G-E insulating varnishes has been issued. It includes specifications, electrical properties, film properties, cure and aging, chemical properties and baking and air drying cycles of each type.

53—Horizontal Milling Machine

Van Norman Co.—New bulletin designed to give concise and complete information on the No. 2 Heavy Horizontal Milling Machine. It covers important design features, both construction and operation. Among the many features pictured and described are the heavy built-in spindle fly-wheel which assures smooth, uniform transmission of power from spindle to cutter. Another important feature of the machine which is described is the excep-

tionally rigid, well-designed spindle. Other features described include the heavy-duty column, front and rear directional controls, new improved over-arm, single lever feed selector and single lever speed selector.

54—Hydraulic Power Pack

Vickers, Inc.—Bulletin 46-48 describes and illustrates the Vickers Hydraulic Power Pack. In addition to schematic diagrams of operation, an installation diagram is included, together with specifications and performance data.

55—Motor Operated Flash Welders

Progressive Welder Co.—Technical Bulletin No. 204 describes Progressive's improved line of motor operated flash welders. The bulletin contains complete specifications, photographs of machines and detailed closeups. There is also a phantom-cutaway sketch of a typical machine with labeled arrows locating operational features and the main working parts.

56—Power Jacklift

Lewis-Shepard Products, Inc.—8-page illustrated booklet describing their new Electric Lift Truck, the Power Jacklift. Two models are included, the Platform Model and the Pallet Model. Specifications and outline dimensions are given for both models.

57—Automatic Processing Machines

National Automatic Tool Co., Inc.—28-page booklet on automatic processing machines for drilling, tapping and boring. Actual case studies are described and illustrated.

58—DC Silicones

Dow Corning Corp.—DC Silicone products are described in the third edition of the company's catalog, Dow Corning Silicones, New Engineering Materials. It contains many charts and graphs, descriptive of the unusual properties of these silicones.

59—Miniature Precision Bearings

Miniature Precision Bearings, Inc.—4-page bulletin on miniature ball bearings for precision instruments and mechanisms describes in detail five series—radial, super-light radial, pivot, angular contact and thrust. Complete specifications are given including load ratings recommended for average typical requirements.

60—Multi-V Belts and Magic Grip Sheaves

The B. F. Goodrich Co.—The Belt leaflet, Catalog Section 2170 describes the various types manufactured. Magic Grip Sheaves, Catalog Section 2175, describes the sheaves, pictorially shows how it works and includes a table showing pitch diameters and bushing sizes of all sheaves carried in stock.

61—Diamond Tools

The Desmond-Stephan Mfg. Co.—Bulletin No. D-8, The Desmond Diamond Tool Reference Guide, a new 4-page illustrated bulletin lists diamond hand tools, diamond wheel dressers for valve grinding machines and straight shank diamond tools and nibs. Pointers on the proper use of the tools is included.

New Car, the Playboy To Be Built in Buffalo

The Midget Motor Car Manufacturing Corp., Buffalo, N. Y., has announced its new 1948 Playboy automobile, the first car to be produced in Buffalo since the Pierce Arrow. It was displayed in Buffalo from Feb. 18 to 25.

According to Charles D. Thomas, vice-president of the company and designer of the car, the Playboy will feature rear engine drive, four-wheel independent suspension and auto-matic drive, no clutch pedal, and no gear shifting. It is anticipated that production of the Playboy will be started May 1 in a building in which 32,000 sq ft will be allocated for stamping, painting and assembly of the new car and in which over 1,000 persons will be ultimately employed by the new corporation.

The Playboy is a convertible type car with an over-all length of 13 ft, a height of 54 in., and an over-all width of 58 in. It weighs 1820 lb and the width of the seat is 4 ft, 3 in. The Playboy is built with a special L-head, four-cylinder Continental water-cooled engine mounted at the rear. The front section contains a luggage compartment with 10 cu ft of storage space. The four-wheel independent suspension incorporates individual coil springs. Brakes are four-wheel hydraulic type. The new car is designed to give 91 per cent vision due to the complete lucite rear panel which goes around the hood, and the special windshield frame in the front. Among other features is an all-steel, all-welded integral body and frame. The maker claims that the car will give 35 to 45 miles per gallon in city driving with a top speed of 60 mph.

Dies and hydraulic presses have already been set up at the plant, and a tentative schedule calls for the production of a thousand cars during the balance of the year. The manufacturer expects to establish an initial selling price of \$950, which may be reduced to \$750 as quantity production is obtained.

Discount Trouble Seen as a Three-Way Battle Among Dealers, Makers and Workers

Discount trouble appears to be coming up in the automobile industry as a potential three-way battle among automobile dealers, car manufacturers, and hourly rated employees as represented by unions. First hint of difficulties arose at the National Automobile Dealers' Association Convention in Atlantic City when dealers charged that General Motors was planning to grant discounts to hourly rated employees, particularly on Chevrolets. According to the best information available, the request for discounts originated among plant employees who pointed out that discounts on new cars are available to upper management employees. Apparently, the matter was discussed in the inner councils of GM and when word leaked out to dealers they immediately became alarmed.

The situation was clarified somewhat by a statement from C. E. Wilson, GM president, who said that the corporation has a plan to permit supervisory and other salaried employees who are classified as exempt under the Fair Labor Standards Act to purchase new cars at a 10 per cent discount. The number of cars sold is limited to one percent of total production, and automobiles delivered by the dealer under the plan are supplied by the company in addition to his regular allotment. The statement, however, does not mention any proposed plan to extend discounts to hourly rated employees and the implication is that such action is not contemplated at this time.

Officials of the corporation were non-committal about the possibility of granting discounts to plant employees, but other sources indicate that there may be repercussions from the union on the issue. If that is true, GM would be squarely in the middle with its powerful dealer group opposing the plan and the equally powerful labor interests plugging for it.

Ford and Plymouth dealers at the convention joined Chevrolet dealers in condemning the action. They point out that in factory towns especially they would be seriously affected. The whole discount situation came up for review at the convention, resulting in a resolution directing the executive committee to designate dealer representatives to hold conferences with various factory managements to canvass the situation thoroughly. Discounts to plant employees are not unknown in the industry since Kaiser-Frazer and Hudson both allow hourly rated employees to purchase cars at a ten per cent discount.

In addition to the protest over delivery of cars to employees of the manufacturers and other groups at little or no profit, the dealers listed the following trends as of considerable concern:

1. Reduction of discounts in certain

- lines; 2. Reduction of discounts on parts; 3. Billing of accessories at the same discount as cars; 4. Hedging on policy adjustments by manufacturers; 5. The increase in charge for advertising which is absorbed by the dealer.

Kaiser-Frazer to Build Some of Own Engines

Under an agreement with Continental Motors Corp., Kaiser-Frazer Corp. will build part of its own engines, using Continental plant facilities, tools, and equipment. The five-year agreement calls for a lease of the large central part of the Detroit plant at a specified rate per sq ft, a fee for use of tools and equipment owned by Continental, and a royalty payment on each engine built. Part of the tools in the plant already are K-F property. Projected schedules call for production of about 1000 engines a day by next summer.

It is understood that Continental will continue to supply engines to K-F from its Muskegon plant, which has a maximum capacity of 500 per day. The arrangement also licenses K-F to build engines at other locations, and it is understood that plans are in the making to include engine manufacture on the West Coast when operation begins there. It is not unlikely, too, that the agreement may have something to do

with the recent announcement that manufacture of Rototiller farm machines would be moved out of Willow Run. Possibly, the installation of an engine line at the home plant to occupy the space now being used to build Rototillers may be planned.

Employees now working for Continental at the Detroit plant will be taken over by K-F along with the facilities. Arrangements have been worked out with the union for the transfer with seniority protection.

Nash Aiming to Hold Present Market Position

Nash Motors Division of Nash-Kelvinator Corp. has attained a penetration of approximately 6 per cent in its present markets in attempts to hold that position in the low and middle priced car field, according to H. C. Doss. The Nash dealer organization currently consists of 1,224 retail outlets.

Weekly Production of Cars and Trucks in U. S. and Canada

Week-ending		1947	Corresponding Week in 1941
Jan.	4.....	53,437	76,690
	11.....	64,828	115,935
	18.....	75,166	124,025
	25.....	93,278	121,948
Feb.	1.....	94,114	124,400
	8.....	89,958	127,675
	14.....	97,276	127,510
	21.....	102,098	127,740
Total.....		670,155	945,923

1948 Playboy



This recently announced convertible type automobile which was displayed in Buffalo, N. Y., features rear engine drive, four-wheel independent suspension and auto-o-matic drive, no clutch pedal, and no gear shifting.

After 19 Years, Ford Trucks Return to Highland Park Plant

For the first time in 19 years Ford Motor Co. truck production has returned to its original home at Highland Park, Mich., where the first Ford truck rolled off the line in 1917. Current truck operations at Highland Park began in February 1947 in a \$2,100,000 facility featuring a final assembly line 1410 ft in length as contrasted with an 800-ft line at the Rouge. Ford is producing 100 different truck models at Highland Park as well as in 13 branch assembly plants throughout the U. S. A.

In a floor space of a little less than half a million sq ft, Ford will schedule a production of about 400 vehicles a day. The move from the Rouge gives the much needed space for accelerating production of motor cars.

In creating the new plant the company has followed the pattern of modern mass production: the use of straight line methods; adoption of mechanical handling systems to eliminate manual handling and lifting as far as possible; and utilization of automatic methods wherever possible to reduce manual operations. The combination of these results is greater output and lower manufacturing costs.

The problem of scheduling the gamut of truck specifications has been solved by the installation of the familiar Telautograph system with a central booth located at the body scheduling line on the second floor and receiving stations at 12 strategically located points in the plant. This is effective in tying together the functions of sub-assembly lines, the body drop, wheel and tire assembly, sheet metal, and so on to assure smooth flow along the final assembly line.

Out of the many conveyor lines found here, one of the most interesting is the main distribution conveyor which traverses the entire plant and has a developed length of 4600 ft. It carries wheel assemblies, sheet metal and other parts to the final line.

Production operations take place on three floors of the plant. Bodies and cabs are received from Budd, painted and trimmed, and delivered to the third floor where they are distributed over a group of slat type storage conveyors having a capacity of about 600 bodies. A feature of this department is the "automatic transfer" station by means of which bodies are moved automatically from the receiving line onto each of the storage lines. It consists, essentially, of a chain for moving the bodies across the ends of the storage lines. As a body is pushed onto the transfer station a limit switch operates to raise an elevator section over the chain, then another switch lowers the elevator so as to rest the body on the transfer chain. The operator then selects the storage line onto which the body will be transferred.

Another interesting spot is the machine designed for rolling in the ring on wheel and tire assemblies. The machine has a series of three rollers for pressing the ring into place. Upon completion of this operation the wheel is slid onto a hinged conveyor section arranged to lift it into an upright position against a vertical frame. It is then rolled down to the turntable machine for automatic inflation of tires. Feature of the inflation machine is the provision of four air pressure headers, each having a different pressure range, thus making possible the proper inflation of different tire sizes.

Bodies are moved from storage to nine scheduling lines on the second floor. Delivery of bodies to the body drop over the final line on the main floor is converged to a single scheduling line and it is at this point that the central Telautograph dispatching station is located.

Because of the variety of body types two separate body drops are provided. The first handles cabs only; the second, a little farther down the line, takes care of bodies and platforms.

Final assembly is in two stages—the chassis line and final assembly. High cycle portable tools are used for making up fastenings while rivets are made up with cold squeezers which are powerful and silent in action.

A novel feature of the assembly line is the overhead rail-mounted roll-over mechanism. It has two basic functions. The first is to provide an automatic means of rolling the chassis from its original upside-down position, gradually, to the right-side-up position re-

quired for the final line. This eliminates the conventional methods of rolling over by means of a sling or other device requiring either manual operation or an operator's control. The second function is to provide a better means of transporting the chassis through the paint spray booth. Mounted flexibly on a monorail the chassis is easier to spray and permits operators to reach otherwise inaccessible places.

The overhead mechanism consists of a double-end sling for attachment to the chassis. At one end is a spoked wheel with an outboard bearing at the end of each spoke. Along the monorail track there is a series of short curved rails which engage the spoke and cause it to deflect through a predetermined angle. These guides engage one spoke at a time until at the end of the chassis line the frame has been turned 180 deg from its original position. Guide rails are so arranged that as the chassis reaches the first spray booth it has been turned 85 deg and continues at that inclination until it emerges from the second spray booth.

The lower floor contains six assembly lines all synchronized for the same speed through a common panel board. The final assembly line has 80 work stations from start to finish. In keeping with the principle of reducing manual handling, Ford has installed overhead rail-mounted air hoists for handling wheel and tire assemblies. Arrangement is such that wheels are picked off the conveyor transversing the final line, moved to the axle and held in proper relation to the hub to facilitate alignment of bolt holes and fastenings.

Front and sheet metal is built up as an integral unit on a large merry-go-round containing 14 individual platforms moved by means of a power-driven conveyor chain.

Wide Range of Products Displayed by Magnesium Industry at Wright Field

Billed as the greatest presentation of products made of the lightest structural metal, the Magnesium Exhibition in February at Wright Field, Ohio, fulfilled that claim. It was held under the joint auspices of the Army Air Forces and the Magnesium Association with close to 5000 executives, engineers, designers and other technical specialists in attendance from industry, Government and scientific institutions, including representatives from automobile and aircraft companies. The large crowds were impressed by the size of the magnesium industry as evidenced by the several thousand magnesium products showing applications in the aircraft, automotive, military, consumer goods, and other fields. During the war the output of the industry was increased from 3350 tons in 1939 to 240,000 tons in 1943.

Thirty-four companies showed ex-

hibits during the three days. In addition to finished products and demonstrations of the chemical, physical and mechanical properties of magnesium, they displayed a large variety of castings, forgings, extrusions; formed, drawn and spun parts; finishes as enamel coatings and plating, and methods of joining. Most parts were for airplanes and piston and jet engines, but also of interest were such applications as truck bodies, plant hand trucks, portable tools, scoops, conveyors, and tire molds. Exhibits were planned to demonstrate advantages as such light weight, high strength-weight ratio, low machining costs, payloads gains, low physical fatigue and smaller handling and transportation costs. Revere Copper and Brass, Inc., exhibited a cutaway sample of a 12-ft panel body made of magnesium extrusions, castings and

sheets, weighing 800 lb complete. About 90 trucks with this type of magnesium body are now being operated by companies in various parts of the country.

Wyman-Gordon Co. showed two experimental magnesium forgings—a piston and a jet engine impeller. With possibly a few other exceptions, all parts on display were made during the war or are in production. Among the developments in the experimental stage, but not exhibited, are wheels and brake shoes for trucks and buses, and hydraulic impellers.

Eaton Had No Strikes in 1946

In an article entitled "1946 a Year of Calamity" which appeared in the December 15 issue of AUTOMOTIVE AND AVIATION INDUSTRIES, it was incorrectly stated that the Eaton Manufacturing Co. (truck axles) was among those suppliers on strike sometime during 1946. Eaton is justly proud of the fact that not an hour of work was lost in its axle plant during the year.

CALENDAR

Conventions and Meetings

- Amer. Soc. of Mechanical Engineers—
Spring Mtg., Tulsa.....Mar. 2-5
- Amer. Soc. of Lubrication Engineers—
Annual Convention, Pittsburgh,
Mar. 17-19
- Amer. Soc. of Tool Engineers—Fifteenth
Annual Convention — Houston,
TexasMar. 19-22
- Amer. Soc. for Metals, San Francisco,
Mar. 22-27
- Midwest Power Conference, Chicago,
Mar. 31-Apr. 2
- Nat'l Assoc. Corrosion Engineers, Na-
tional Convention, Chicago...April 7-10
- Soc. of Automotive Engineers, Aero-
nautic Mtg., New YorkApril 9-11
- Soc. of Automotive Engineers, Trans-
portation Mtg., Chicago.....April 16-18
- Chamber of Commerce of the United
States, Annual Mtg., Washington,
D. C.Apr. 28-May 1
- Amer. Foundrymen's Association, An-
nual Convention, Detroit..Apr. 28-May 1
- Soc. of Automotive Engineers, Personal
Airplane Mtg., Wichita, Kansas,
May 1-2
- The Society of the Plastics Industry,
Nat'l. Plastics Exhibition, Chicago,
May 6-10
- Soc. for Experimental Stress Analysis
Annual Mtg., Chicago.....May 15-17
- Nat'l Assoc. of Motor Bus Operators
Annual Mtg., Chicago.....May 21-23
- Amer. Soc. of Mechanical Engineers—
Oil & Gas Power Nat'l Conference—
ClevelandMay 21-24
- Amer. Soc. of Mechanical Engineers—
Aviation Mtg., Los Angeles...May 26-29
- Auto. Engine Rebuilders Assoc. Con-
vention, DetroitMay 22-24
- Metal Powder Assoc., Spring Mtg., New
YorkMay 27
- Soc. of Automotive Engineers—Summer
Mtg. French Lick Springs, Ind..June 1-6
- Amer. Soc. of Mechanical Engineers—
Semi-Annual Mtg., Chicago..June 16-19
- Amer. Soc. of Testing Materials—An-
nual Mtg., Atlantic City.....June 16-20
- Soc. of Automotive Engineers—West
Coast Transportation & Mainte-
nance Mtg., Los Angeles....Aug. 21-23
- Amer. Soc. of Mechanical Engineers—
Fall Mtg., Salt Lake City....Sept. 1-4
- Society of Automotive Engineers—
Tractor Mtg., Milwaukee....Sept. 17-18
- Natl. Machine Tool Builders Assoc.
Machine Tool Show, Chicago,
Sept. 17-26

March 1, 1947

PERSONALS

*Recent Personnel Changes and Appoint-
ments at the Plants of Automotive and
Aviation Manufacturers and Their Sup-
pliers.*

Reo Motors, Inc.—R. M. Palmer,
Sales Engineer.

Packard Motor Car Co.—Sydney J.
Keith, Public Relations Supervisor.

Nash Motors Div., Nash-Kelvinator
Corp.—Floyd G. Sease, assistant to the
Sales Manager.

Willys-Overland Motors—Paul Hu-
ber, Director of Research; Robert E.
Busey, in charge of Truck Engineering;
Walter F. Benning, Technical Assistant
to Delmar G. Roos, Vice-President and
Director of Engineering. He will be in
charge of passenger car engineering.
Leo O. Burt, Passenger Car Chassis En-
gineer; Charles Cuma, Engine Develop-
ment Engineer, and F. L. Mills, Chief
Draftsman of the Chassis Div. Charles
E. Schutte, Chief Engineer, Body Div.,
with A. C. Smith as Asst. Chief Engi-
neer. Charles E. Barber, Body Engineer
in charge of Mechanical Engineer, and
Fred M. Baker, Chief Draftsman of the
Body Div.

Fruehauf Trailer Co.—I. C. Moreau,
Asst. Manager, Tank-Trailer Div.

Ford Motor Co.—James W. Irwin,
Asst. to the president and director of
public relations. Robert R. Nash, di-
rector of the recently organized Pur-
chase Analysis Dept.; Frank J. McGin-
nis, Director of Sales Promotion.

Lincoln-Mercury Div., Ford Motor Co.
—Carl F. Schultz, Resident Engineer.

Crosley Motors, Inc.—John Jay
Walsh, head of the newly formed ad-
vertising department.

Chevrolet Motor Div., General Mo-
tors Corp.—E. W. Sly, retiring after 28
years with the purchasing department.

The Electric Auto-Lite Co.—E. A.
Spencer, Sales Office Manager; K. B.
Woyame, National Accounts Manager.

Detrex Corp.—Dr. W. L. McCracken,
appointed director of research and man-
ager of alkali manufacturing.

Menasco Manufacturing Co.—Jack
W. Crawford, Manager, Automotive and
Industrial Div.

Raybestos-Manhattan, Inc., Asbestos
Products Div.—George W. Marshall,
Jr., General Sales Manager.

The Goodyear Tire & Rubber Co.—
Resignation of Cliff Slusser as Vice-
President in charge of production and
as a member of the board of directors.
He will continue with the company as
vice-president and general manager of
the subsidiaries which operate the com-
pany's domestic textile plants and coal
mines. Russell De Young succeeds Mr.
Slusser. Fred W. Climer was elected to
a new vice-presidency in charge of in-
dustrial relations.

United States Rubber Export Co.,
Ltd.—John B. Tower, executive as-
sistant to the president retired on
March 1.

Towmotor Corp. — Charles Edgar
Smith, advanced to the newly created
position of executive vice-president.

L. A. Young Spring & Wire Corp.—
N. D. Ely, elected vice-president and
general manager to succeed the late C.
M. Young. Thomas Couper, General
Sales Manager, was elected to the
Board of Directors. Grant L. Cook, also
elected a member of the Board of Di-
rectors.

Tung-Sol Lamp Works, Inc.—P. R.
Dawson, Sales Manager for renewal
sales.

TelAutograph Corp. — Robert L.
Spotts, elected executive vice-president.

Besler Corp.—T. E. Colvin, executive
vice-president and director.

Goodyear Aircraft Corp. — T. A.
Knowles appointed vice-president and
general manager and Charles H. Zim-
merman named factory manager. Rus-
sell DeYoung, vice-president and gen-
eral manager has been named vice-
president and a member of the board
of directors of the parent firm, Good-
year Tire & Rubber Co.

Piston and Pin Mfrs. Form Permanent Group

At a regular meeting held at Chicago
last January, the Piston and Pin Man-
ufacturers formed a permanent group
of nearly all of the makers of pistons
and piston pins, particularly in the re-
placement field. A constitution was
adopted in order to formalize the In-
dustry into a group.

An Executive Committee composed
of the following was elected: Burt G.
Close, McQuay-Norris Mfg. Co.; Otto
W. Brown, Wisconsin Machinery and
Mfg. Co.; Martin J. Skok, Elgin Ma-
chine Works; Paul C. Johnson, Sealed
Power Corp.; and H. A. Lightner, De-
luxe Products Corp. Burt Close was
appointed chairman to serve the first
year, and Frank M. Speaker was ap-
pointed executive manager.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE and AVIATION INDUSTRIES

Moderate reductions in general business activity are indicated. The *New York Times* index for the week ended February 8 stands at 143.8, as against 147.6 for the preceding week and 112.5 a year ago.

Sales of department stores during the week ended February 8, as reported by the Federal Reserve Board, equaled 219 per cent. of the 1935-39 average, as compared with 217 per cent. in the week before. Sales were 2 per cent. above the corresponding distribution a year earlier, as against a preceding similar excess of 10 per cent. The total in 1947 so far reported is 17 per cent. greater than the comparable sum in 1946.

Electric power production increased slightly in the week ended February 8. The output was 20.5 per cent. above the corresponding amount in 1946, as compared with a like advance of 19.9 per cent. shown for the preceding week.

Railway freight loadings during the same period totaled 767,481 cars, 8.1 per cent. less than the figure for the week before but 7.6 per cent. above the corresponding number in the preceding year.

Crude oil production in the week ended February 8 averaged 4,770,250 barrels daily, 120,100 barrels more than the preceding average and 79,750 barrels above the comparable output in 1946.

Production of bituminous coal and lignite during the week ended February 1 is estimated at 13,775,000 net tons, 4 per cent. above the output in the week before and higher than any output recorded since 1926. The total production in 1947 so far reported is 4.5 per cent. above the corresponding quantity in 1946.

Civil engineering construction volume reported for the week ended February 13, according to *Engineering News-Record*, is \$54,778,000, or 51 per cent. below the preceding weekly figure but 24 per cent. above the comparable sum in 1946. The total recorded for seven weeks of this year is 33 per cent. more than the corresponding amount in 1946. The increase in private construction is 30 per cent. and the rise in public construction is 40 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended February 8 is 141.7 per cent. of the 1926 average, as compared with 140.3 for the preceding week and 107.1 a year earlier.

Member bank reserve balances declined \$101,000,000 during the week ended February 12. Underlying changes thus reflected include an increase of \$588,000,000 in Reserve bank credit and a rise of \$549,000,000 in Treasury deposits with Federal Reserve banks, accompanied by an increase of \$51,000,000 in money in circulation.

Total loans and investments of reporting member banks decreased \$267,000,000 during the week ended February 12. An increase of \$173,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$10,673,000,000, shows a net increase of \$3,312,000,000 in twelve months.

British Car Output Down Because of Coal Shortage

Closing the year with a total production of 365,282 automobiles, of which 219,162 were passenger cars and 146,120 were trucks, the United Kingdom faces a bleak new year because of the coal shortage and consequent shut-downs.

By mid-February practically the whole of the British automobile industry was shut down, either because of the coal shortage, electric current cuts or inability of supply firms to furnish goods. Austin was the first to be affected and is now completely closed. Morris was affected by unbalanced production and by mid-February was 2,100 cars and trucks below schedule. Ford laid off 14,000 employees on February 19 because of inability to get parts from firms in the Midlands, and Vauxhall is closed with a loss of 270 cars per day.

Of the tire factories Goodyear and Michelin are closed indefinitely and only one of Dunlop's 14 factories is operating and that one is producing cycle tires.

Official figures give the number of unemployed on February 18 at 2,493,149 for all of Britain. The crisis is due to low coal extraction and inadequate stocks at the beginning of what has proved to be an unusually severe winter. Even if the weather had remained normal there would have been some dislocation of industry, but with

roads blocked and railroads crippled, the shortage has become a calamity.

When the unemployed reached a peak of about two and a half millions, 1,212,400 were drawing out of work allowances from public funds. Automobile manufacturers generally met the guaranteed week for one week only, and after that laid off most of their staffs owing to the inability to meet the heavy financial charges.

Coal production is increasing and stocks are being built up by reason of restrictions applying to private users, transportation agencies, public utilities, and publishers. While it is debatable when these restrictions will ease, undoubtedly industries will start gradually, and assuming that weather conditions become better, a full month may elapse before automobile production returns to its December level of 26,827 units.

Meanwhile the whole British export program has been knocked out of gear. Last year 147,480 automobiles were exported. With January production poor and February output practically nil, it is very doubtful if this record figure can be attained in 1947. England's plan of digging into foreign markets while there was a world shortage is seriously jeopardized.

The shortage of British automobiles will not benefit any other European country. Last year France produced only 96,062 motor vehicles, of which 30,429 were passenger cars and 65,633 trucks and buses. Owing to coal shortage the four-day week is general.

Late Slants on High Prices

(Continued from page 32)

runs from \$1500 to \$2000, the unpaid balance would run from \$1000 to \$1500. With payments limited to 15 months, the average monthly payment counting insurance would run from \$75 to \$100. A general rule is that the ratio of payment on an automobile to total income should not exceed 15 per cent. On this basis, it would take an income of \$500 a month to buy a new car on time. With savings depleted by strikes and intermittent production last year, it is difficult to see how most factory employees would be able to handle such a deal. The situation is not alarming, however, since there now is a strong movement afoot to scrap Regulation W and, in any event, the credit curb dies next June 30 if not renewed by Congress.

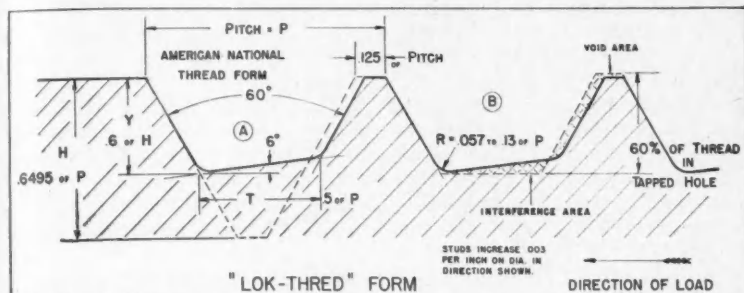
Dealers report that up to now deals have been 90 per cent cash and ten per cent credit. They say, however, that in recent weeks there has been a slightly upward trend in finance buying and they expect it to increase steadily. Before the war about 50 per cent of all new car purchases were financed.

While, for all practical purposes, the market for most makes of cars will remain solid for many months, there have been indications that car manufactur-

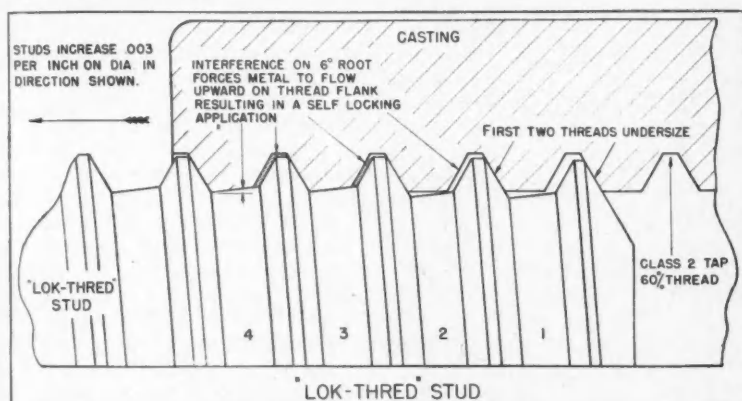
ers' sales departments are preparing for the inevitable buyers' market. Chevrolet, for example, is urging its dealers to reactivate their used car departments and to hire sales managers. Ford, Chevrolet, and Chrysler Divisions all are extremely busy on training programs for automobile salesmen. Regional meetings are being held and training devices such as slide films are being used in teaching salesmen how to sell.

There is no argument that the want and need for new cars exists. The only problem facing the mass market is the ability to buy. That is why price is going to become increasingly important later this year. A recent survey by R. L. Polk & Co. shows that 25,142,527 cars were registered in 1946. Since about 2,230 million were built in 1945 and 1946, the remaining 22,912 million, or 91 per cent, are five years old or more. The average age of cars on the road today has been estimated at close to nine years, which means that many millions are decrepit and will go to the junk heap in greater numbers as more new cars become available. An interesting comment on the potential market has been made by H. C. Doss, Nash Sales manager. He said that the number of family units has been in-

"LOK-THRED" STUDS BECOME TIGHTER IN SERVICE



The heavy black line illustrates the "LOK-THRED" form superimposed on the American National Thread form indicated by the dotted lines, position A picturing the comparison in the male thread of each. Position B diagrams the action that occurs as the male "LOK-THRED" enters the 60% American National Thread tapped hole. The metal from the crest of the female thread (shown as "interference area") is caused to flow along the helix angle of the male "LOK-THRED" completely filling the void between the flanks of the two mating threads (indicated as "void area"). This creates a positive seal and firmly anchors the stud.

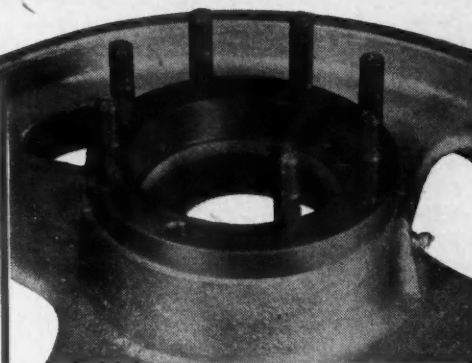


This pictures in detail the sealing and locking action that occurs as the "LOK-THRED" Stud is driven into the tapped hole. The reforming of the crest of the female thread begins at or before the second thread and this will completely fill the voids starting with the third or fourth thread. The .003" or more thread taper of the "LOK-THRED" Stud increases the interference and supplements the flow of metal just described to produce an increasingly firm anchor as the stud is driven to the depth desired.



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These diagrams show why "LOK-THRED" Studs lock more securely than American National Threads, and why they are chosen for such applications as this differential axle driving flange used by the Silent Hoist & Crane Company on their "Krane Kar".

Notice in the diagrams the 6° angle at the root of the "LOK-THRED" which carries the entire normal load under high compressive pre-stress. This avoids the chief weakness of standard interference fit, which tends to cause a bursting or splitting action by placing the metal of the receiving thread under shear.

10 ADVANTAGES OF "LOK-THRED" STUDS

1. Lock securely and become tighter in service.
2. Have much higher fatigue limits than studs with conventional threads.
3. Stronger in both tension and torsion than ordinary American National Threads.
4. Carry entire normal working load on 6° angle at root of thread under high compressive pre-stress.
5. Modified American National Threads permit use of standard tools.
6. Re-usable and on any re-application less than one-half additional turn brings torque back to its original installation value.
7. Do not require selective fits.
8. Do not gall when being driven nor fret in service.
9. Act as dowels and taper pins.
10. Seal positively and eliminate added bosses and blind tapping.

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

creased by 10 million since 1929, and that even after three five-million car years, the industry still would provide only 79 per cent of a car per family unit, five per cent under the 1929 figure of 84 per cent. He called for repeal of Regulation W, and said that buyers should have 18 to 24 months to pay for an automobile, since experience of the past few years has shown that an automobile is good collateral for a loan for five or six years.

The delivery situation will probably get steadily easier until eventually the dealer will get a car in his show room for which he has no buyer waiting. This will be the most likely time for the first crack to appear in the price structure. When the dealer finds that he has trouble moving the car, he will resort to his former practice of overtrading on a used car, and shave his own discount. That is likely to continue for a period and then most likely will be followed by a reduction in the list price at the factory. In fact, some spokesmen for the industry state unofficially that they think it is entirely possible that prices may come down about the end of this year. Manufacturers are all doing well at present, as indicated by the restoration of the General Motors dividend to \$.75 from \$.50 a share and the payment of the first dividend in two years by Packard.

30 Millionth Inch Tolerance

(Continued from page 21)

which goes with the plunger. This starts as 25/32 in. round bar stock of GM 7520 alloy steel, turned, drilled, counterbored, reamed and cut-off in a 1% in., 8-spindle Conomatic. The part is countersunk at the bottom end in a drill press, rough ground on the OD in a 4 x 12 Landis cylindrical grinder, then proceeds to the second operation—drilling, reaming, centering, and facing of the head end—in a No. 2 Brown & Sharpe automatic.

Using the same principle as on previous routings, the initial roughing operations are followed by degreasing, hardening, drawing, and sand-blasting, developing a hardness of 40-45 Rockwell C. Then come the grinding operations—Cincinnati Centerless grinding, Norton surface grinding, and the rough- and finish-grinding of the ID plunger hole to plug size. These basic steps are followed by degreasing and nitriding to finalize the required characteristics.

Bushings are classified according to plug size and honed in No. 1 Micromatic horizontal honing machines. Then we have a series of external grinding operations, wash, and Magnaflex inspection, burring, washing, and dimensional inspection. Bushings are classified again according to plug gage size and are machine-lapped on the ID in two-spindle No. 1 Micromatic honers. Plunger holes then are checked ac-

Nash also did very well in the last quarter. Present prices are undoubtedly predicated on low volume and the unusual costs involved during the reconversion period. They also are intended to help recover the large financial losses suffered last year.

It is generally known throughout the industry that it will be possible to reduce prices when the need arises, since at that time volume will be up, reconversion costs will have been discharged, and the many unusual costs arising from lack of materials will be largely eliminated.

On the debit side, it must be noted that material costs still are increasing somewhat, as a result of the time lag in a wage increase in supplier industries last year, and another wage raise in the automotive industry might be forthcoming. However, there is some basis for the belief that material costs can be shaved in the future and that any wage increase will be a very moderate one. Another important factor is that amortization charges on practically all dies and tooling used to build present cars have been discharged. In short when buyer resistance to present high prices develops, the industry is not going to close down for lack of sales, but is going back to the prewar practice of reducing prices in line with competition.

curately for size by means of Sheffield Precisionnaire gages.

To summarize the foregoing, it may be noted that plungers are finish ground in successive steps to meet a band of established diameters corresponding to the desired clearance in sized bushings. During the process, each plunger is checked for gage size by means of P & W Electrolimit gages. At DE, Electrolimit inspection is a production job, each grinder being fitted with one of the gages.

Similarly, the bushings ultimately reach the hand-lapping stage where operators meticulously lap the bore to a fine superfinish. At this point the bushings are sized by means of standard plug gages and are segregated in accordance with size bands.

The most important step in the entire process is the mating of bushings and plungers to obtain sets having the proper clearance. Since this clearance is of the order of 30 to 60 millionths of an inch, matching is a job of extraordinary precision. While there are various means of establishing clearances of this character by indirect methods, such as a pressure-time-leakage test for example, the engineering department insists upon direct measurement so that the actual value of the clearance may be certified. To accomplish this, they have developed a method of air gaging, using a sensi-

tive manometer so calibrated as to give dimensional readings corresponding to the position of the meniscus.

Once the plunger and bushing have been paired and calibrated for clearance, they are held together until they reach the final injector assembly line. It is worthy of comment that before injectors are assembled, all of the component parts which had been previously cleaned and degreased, are degreased again in a Detrex unit and given an oleum spirits flush.

As illustrated, the injector assembly line consists of a closed rectangular merry-go-round conveyor with assembly benches both inside and outside of the line. Assembled injectors are prepared by the operator at each station, then laid on the conveyor for transport to the initial inspection station. Accepted assemblies go to the test department for final calibration, where they are installed in the test machine and run for an hour to break in the mechanism. Following this, the machine is switched for calibration.

To assure surface quality and close dimensional control, the plant is provided with a central filtering department for cutting fluids and oleum spirits. Here they have two filtering and rectifying units—one for cutting fluids, the other for oleum. Since the operation does not warrant a circulating system, each of the machines is drained periodically and the material then transported to the filtering room for processing.

Engineering research and metallurgical control give the operation the spark of product development and control of quality. In addition to the usual design facilities the plant features a test department with eight test blocks quite similar in set up to the modern test cells developed for aircraft engine dynamometer testing during the war. This provides outstanding facilities for testing the product by itself and on engines mounted on dynamometer stands. The metallurgical department operates a comprehensive laboratory with familiar equipment for chemical testing and research, physical testing, etc.

New Federal Trucks

(Continued from page 27)

and safety glass. To prevent breakage of window glass, the side panes are protected by a steel frame. The windshield glass area has been substantially increased to provide better visibility. Cabs are of all-steel construction and, cushion-mounted on a three-point suspension, using rubber pads with spring-loaded fastenings to absorb violent shock.

The new four-wheel model, the 65MA, is similar to the 65M2 now in production except that it is equipped with a Timken double-reduction rear axle and auxiliary transmission instead of the two-speed axle used on the 65M2. It is powered by the Continental R-6602 engine.

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The Power Pack is available with nominal delivery ratings of 2, 3, or 5 gpm at 1200 rpm and for operating pressures up to 1000 psi. It develops hydraulic pressure to lift, lower, push, pull, stack, load, and hold practically any load... depending on the cylinder size used.

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March 1, 1947

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57

Latest Developments in Engine Bearings

(Continued from page 31)

Bearing B (center): steel-back copper-lead bearing containing 69-74 per cent copper, 26-31 per cent lead, 1.5 per cent silver, and traces of other metals. Average load capacity: 8650 psi (3520 rpm). Average diametral clearance: 0.0032 in.

Bearing C (right): steel-back aluminum-alloy bearing with an alloy layer 0.022 in. thick. Composition of alloy: 6.36 per cent tin; 1.16 per cent copper; 0.87 per cent nickel; 0.20 per cent iron; 0.19 per cent silicon; and 91.22 per cent aluminum. Average load capacity: 9300 psi (3640 rpm). Average diametral clearance: 0.0033 in.

Fig. 2 and the data relating thereto were taken from the NACA Technical Note by Macks and Shaw.

Results of load-capacity tests on bearings of different materials were given also in the paper by Palsulich and Blair. The load capacity varies somewhat with the bearing clearance, the thickness of the overlay, and the composition of the latter. Wright tests were limited to silver bearings with lead overlays of different compositions and different thicknesses, and aluminum bearings of different compositions. The highest unit bearing load in these tests, based on a crankshaft speed 100 rpm less than that at which failure occurred, was 12,300 psi, with a silver bearing with a lead-tin overlay in which the lead constituted 5 per cent of the weight of the bearing. A silver bearing with a normal lead-indium overlay (lead 5 per cent of total weight) had a specific load capacity of 11,200 psi; and increasing the lead content of the overlay to 16 per cent of the total weight reduced the load capacity to 10,600 psi. In this connection it should be remembered that, since the load of the testing machine is due to centrifugal force, any increase in the bearing load is accompanied by an increase in the rubbing speed proportional to the square root of the load increase.

Three aluminum-alloy bearings tested in the Wright laboratories showed an average load capacity of 7000 psi. The aluminum alloys had different compositions, the alloy giving the highest load capacity containing 6 per cent tin, 1 per cent copper and 1 per cent nickel. Aluminum alloys of four different compositions were tested by the NACA, and the one showing the highest load capacity had substantially the same composition as that which gave the best results in the Wright tests. Averaging all of the Wright test results gives a load capacity of approximately 10,800 psi for silver with lead-indium overlay, and 7500 psi for aluminum-alloy bearings. This is somewhat less favorable to aluminum than the NACA results represented by Fig. 2, but it must be remembered that the latter results were obtained from experiments

with what is apparently the best of the various bearing alloys so far, the one containing about 6 per cent tin and about 1 per cent each of copper and nickel.

Micro Bearings

The problem of increasing the load-carrying capacity may be approached from the mechanical as well as from the metallurgical standpoint. The best bearing metals with respect to embedability and score resistance have little mechanical strength, and it has been found that the effects of this deficiency on bearing performance can be minimized by reducing the thickness of the lining or coating of bearing metal. The normal thickness of linings of so called strip-cast bearings is about 0.020 in.; that of centrifugally-cast bearings, 1/32 in. According to E. Crankshaw of the Cleveland Graphite Bronze Co., approximately 50 per cent more load can be carried if the thickness of the lining is reduced from the above figures to 0.002 - 0.005 in. in connecting-rod, and to 0.004 - 0.007 in. in main bearings. Loads can be still further increased by reducing the thickness of the surface layer to 0.001 in., but this necessitates the use of an intermediate layer of a metal having bearing properties, as in the silver bearings of aircraft engines and the trimetal bearings of the Cleveland Graphite Bronze Co. In the latter bearing, the steel back, together with the intermediate layer of 0.013 in. thickness, is formed and machined to close limits, and a surface layer of white metal, 0.001 in. thick, is then applied by electrodeposition, the bearing requiring no further machining. According to Mr. Crankshaw, such bearings will successfully carry loads in excess of 3000 psi, provided the analysis and the structure of the material are carefully checked. Life tests on bearings with successively decreased thickness of surface layer, carried out under a specific load of 2000

psi, showed that reduction of the bearing metal thickness down to 0.014 in. had no influence on the life of the bearing, which was approximately 50 hr. A further reduction in the thickness, however, resulted in a rapid increase in the life of the bearing, to about 230 hr for a thickness of 0.003 in., and to more than 300 hr for a thickness of 0.001 in.

Requirements with respect to bearing life vary greatly in the different fields of application, being lowest in aircraft and highest in stationary engines. The following figures for life requirements in different services were given in Mr. Crankshaw's paper: aircraft, 1000 hr; passenger-car, 2000 hr; tractors and heavy-duty trucks, 4000 hr; railroad engines, 5000 hr; marine engines, 10,000 hr; stationary engines, 15,000 hr.

In automobile service the average load factor of the engines has been steadily increasing, and this naturally has had an adverse effect on bearing life. Owing to road improvement and other changes in operating conditions, trucks and buses are run at close to maximum speeds during longer periods of time. This has led the Cleveland Graphite Bronze Co. to revise its table of load-carrying capacities of different bearings types in different services, the present recommended maximum specific loads, which are lower than the earlier ones in nearly all cases, being as shown in table below.

Grid Bearings

Another line of development having for its object to combine the excellent bearing properties of such metals as tin and lead with the greater hardness and high heat conductivity of copper and silver and the great strength of steel has resulted in the grid bearing. As produced by P. R. Mallory & Co., the steel backing of this bearing is first provided with a lining of copper or silver, which is referred to as the

Recommended Maximum Bearing Loads—Psi.

Passenger Cars	Clevite 77	2500
Tin- and lead-base, conventional.....	Aluminum	1800
thickness	Diesel	
Micro, tin- and lead-base.....	Tin- and lead-base	1000
Copper-lead, 35 per cent lead.....	Copper-lead-silver, 28 per cent lead.....	1800
Clevite 77, precision-plated.....	Trimetal	1800
Auxiliary Drives*	Clevite 77, precision-plated.....	2500
Tin- and lead-base, up to 1500 fpm. 500	Aluminum	1800
Trimetal tin-base, up to 1500 fpm. .. 500	Aircraft	
Clevite 77, precision-plated, up to 2000 fpm	Copper-lead-silver, 28 per cent lead.....	3500
2500	Silver and lead-indium	5000
Trucks and Buses		
Tin- and lead-base micro.....		
Copper-lead, 35 per cent lead.....		
Trimetal		

*This includes generators, superchargers and small high-speed auxiliary engines.

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Windshield glass can be kept warm when coated with an electrically conductive transparent film called "Nesa", manufactured by Pittsburgh Plate Glass Co.

be ready with CONE for today

Eastman Kodak's process of molding small lenses in an atmosphere of nitrogen promises, when manufacturing technique is refined, to produce lenses satisfactory for all but the most critical uses.

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General Electric's new silicone paint is said to permit clearer, brighter colors for automobiles, refrigerators, electric ranges, etc., and to "last a lifetime."

be ready with CONE for today

Air Reduction Co. claims to have perfected a method of flame-cutting stainless steel to close tolerances at high speed without affecting the physical properties of the metal.

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American Cyanamid Co. has installed hot water pipes under 600 feet of roadway connecting its plant with the highway. The heat will keep the road free from ice and snow.

be ready with CONE for today

The Mellon Institute has reported on the use of ethylsilicate as a vehicle in paint. Finishes made with it are said to resist heat, retard fire and not to darken with age.

get ready with CONE for tomorrow

C. G. Conn Ltd. has an electronic organ that produces its tones by vacuum tubes and is said to be equivalent to an organ with 1,333 pipes.

Bell Aircraft Corp. is making a vending machine mechanism that makes change.

be ready with CONE for today

The Dobeckmun Co. of Cleveland is making an aluminum foil yarn, protected by a plastic surface from corrosion, for use in textiles in combination with other yarns.

get ready with CONE for tomorrow

Seal Peel Inc., of Detroit, is sending a shipment of various products, protected only by plastic dip coating, on a round-the-world flight to test the value of this type of packaging in actual service.

be ready with CONE for today

Dow Chemical Company's "Styrofoam" is a pure white cellular insulating material with only 18% of the weight of cork.

Atlas Supply Co., makers of tires and accessories, is showing its wares in a showroom built inside a DC4 and called the "Sky Merchant."

get ready with CONE for tomorrow

Linde Air Products Co. calls its method of flame-cutting rock (as for oil wells) "fusion-piercing." It is said to have drilled holes as deep as 450 feet at an average rate of 10 feet per hour.

be ready with CONE for today

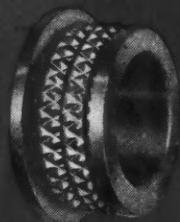
The "Solexol cold fractionation" process developed by M. W. Kellogg Co. is expected to be used in seven plants now building throughout the world. The process resembles that used for petroleum, but is applied to many basic oils and fats including soy bean, linseed, tallow, sardine and shark liver.

get ready with CONE for tomorrow

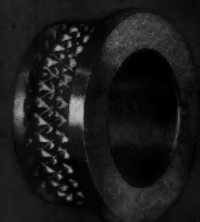
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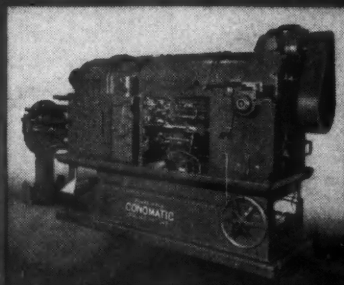
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This piece was produced from 2 1/8" dia. S.A.E. 1112 by 18 tools in 12 seconds on a 2 5/8" Eight-Spindle Conomatic.



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AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

37

base metal, and may be applied either thermally or by electrodeposition. The surface of the base metal is then knurled to form in it depressions of inverted pyramid form. These depressions are filled with lead or lead alloy, and the surface is then machined to remove the excess bearing metal and the peaks of the base metal. In this way a bearing surface is obtained which consists partly of lead and partly of base metal, the lead predominating. Satisfactory results are said to have been obtained with from 20 to 50 indentations per linear in., varying in depth from 0.008 to 0.024 in.

If copper is used as the base metal and lead as the filler, the bearing surface is similar in its characteristics to that of a copper-lead bearing, in which the copper forms a matrix in which particles of lead are embedded. Of course, in the copper-lead bearing the lead is more finely divided. The grid bearing is claimed to have advantages over the copper-lead bearing in that the production processes, being entirely mechanical, can be more accurately controlled.

Grid bearings can be produced by different methods. The base metal together with the backing can be knurled and filled with lead in strip form, and then formed into half-bushings in the same way as babbit or copper-lead strip. In this form it can also be rolled into split bushings. In the case of full-round bearings, the base metal may be electroplated to the backing shell and each bushing knurled individually.

A drawing of a half bearing with an enlarged view of a section through the

grid is shown in Fig. 3; while Fig. 4 is a plan of the half-bushing with an enlarged view of the grid pattern. Either copper or silver is used as the base metal, silver having the advantage of better bearing qualities and copper that of lower cost. Lead alloyed with from 5 to 10 per cent tin is used as the filling material. Grid bearings with either copper or silver base metal are said to be superior to copper-lead and equal to silver bearings with respect to freedom from galling or seizing tendencies; equal to and perhaps even better than babbit bearings as regards embedability, as any grit which enters the bearing is absorbed in the first lead pocket which it enters; and only slightly inferior to silver and equal to aluminum bearings with respect to fatigue resistance. They are claimed to have a load-carrying capacity in excess of that of copper-lead bearings; corrosion resistance equal to that of other bearing types; and a relatively high heat conductivity due to the use of copper or silver as base metal.

During the war grid bearings were installed in a tank engine of the radial type in which copper-lead bearings had worn out in a few hundred hours because of the large amount of sand and grit that entered the engine in service. It is stated that the silver grid bearings in many cases had a longer life than the engine or tank as a whole. In case of incipient seizure, a grid bearing tends to be self-healing, because the high temperature of the local hot spot causes plastic flow of the lead, thus restoring the bearing properties of the seized area.

NEW Products

(Continued from page 47)

trodes. For example, it is claimed that satisfactory usability on alternating current eliminates arc blow and results in easier manipulation, more uniform arc action, and better appearance of deposit. This class of electrodes is recommended by the manufacturer for all applications on which the lime type of electrode is used, with the possible exception of highly restrained joints on heavy sections or on steels of high hardenability.



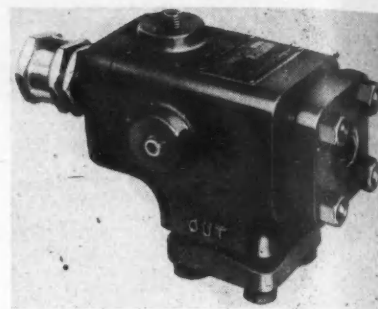
Sonntag Model SF-2 machine

Sonntag Bench-Type Fatigue Testing Machine

To fill the increasing demand for a bench-type fatigue testing machine with the "constant-force" loading feature, the Baldwin Locomotive Works, Philadelphia, Pa., offers the Sonntag Model SF-2 machine. The new machine affords flexure fatigue tests on sheet stock of any material—metal, plastic, wood—and requires no attention during the test. The design eliminates the need for any electronic equipment, complex linkage or special device to maintain a constant force while the specimen is under test.

Baldwin's latest addition to its line of fatigue and simulated service testing machines uses a revolving eccentric mass as a means of loading the specimen. With this constant force machine, the load automatically remains constant regardless of the changes in the amount of deflection of the specimen.

Relief Valve Designed for Extreme Pressures



The Superdrain Corp. of Dearborn, Mich., has announced this new 5,000 psi relief valve which incorporates numerous new features. Squealing and chatter are said to be completely eliminated. Instantaneous action prevents objectionable pressure peaks. Accurate maintenance of pressure setting is an important feature. Hydraulic balance insures high efficiency and long life. Provision is also made for remote control.

A predetermined load is alternately applied to the specimen, and the resulting deflection is incidental.

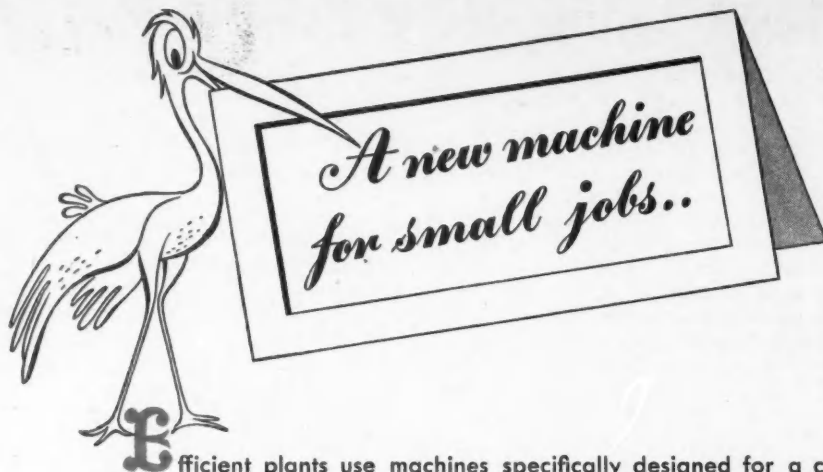
The specimen undergoes the same stresses the material would sustain in actual use and the point of failure is accurately determined. Because of its comparatively small size, 15 in. by 12 in. by 32 in., the SF-2 fatigue testing machine can be placed in a cabinet during a test so that temperature and humidity can be controlled. The machine weighs 115 lb, has an alternating force capacity of 20 lb and a speed of 1800 cycles per minute with a total travel of the loading yoke of one in. per cycle.

Air Pressure Regulator

A new air-pressure regulator has been introduced by A. Schrader's Son, Division of Scovill Manufacturing Co., Inc., 470 Vanderbilt Ave., Brooklyn 17, N. Y. The unit is adjustable to function in systems operating at pressures from 10 to 150 psi. Air to any working part used in conjunction with air cylinders or machine controls is delivered at the pressure for which the regulator is set, which is always less than line pressure; and the pressure at the equipment is maintained constant regardless of any variation in the system pressure. The regulator is furnished with a pressure gage. Many of these units can be used in a system, one for each tool or air-operated machine. The manufacturer states that use of the regulator saves wear on the compressor and reduces air costs.

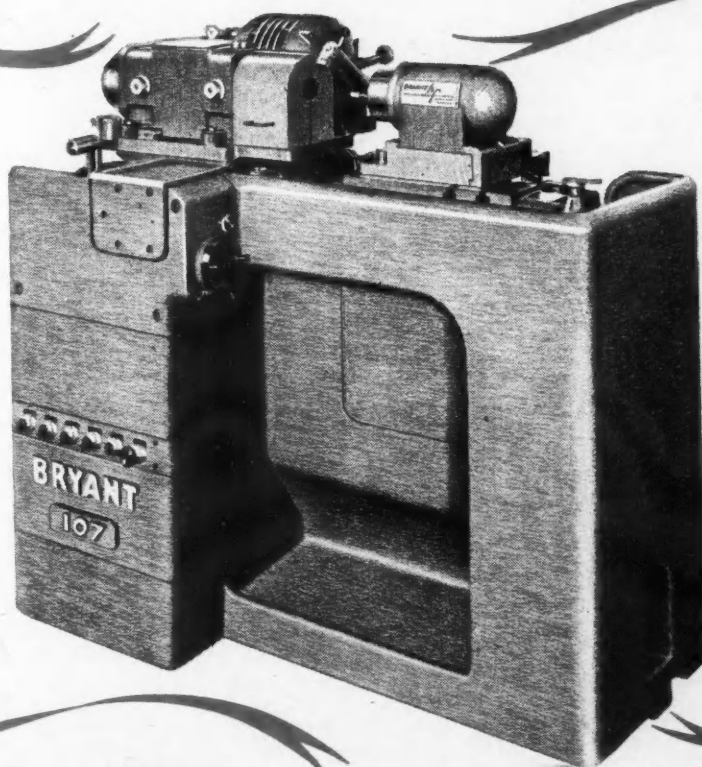
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Efficient plants use machines specifically designed for a certain range of work sizes. For greatest efficiency in the grinding of small holes ($\frac{1}{8}$ " to 3"), Bryant offers the new, small Series 107 Internal Grinder. ● The Series 107 is designed for tool room and small lot grinding. It has a chuck swing of 9 inches, a maximum traverse stroke of 6 inches and a maximum grinding stroke of 4 inches. Provision can be made for 11" swing. Preloaded ball bearings are used on both cross and longitudinal slides. This allows the use of a very light wheel slide, yet provides the utmost rigidity and sensitivity necessary for extremely precise work with quality finish. The new Series 107 uses the Bryant High Frequency Wheel Head as standard equipment. This provides direct wheel spindle drive at speeds up to 100,000 r.p.m., assuring the efficient surface speeds so necessary when grinding small bores. Belt drive is available for slow speeds. ● Although a minimum of floor space is required, operator comfort has been carefully considered. The simplified controls are conveniently located, and the operator may operate the machine, either when standing or sitting. Write for complete details on this new, small internal grinder that is functionally designed to grind small bores.

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SERIES 107
INTERNAL GRINDER
FOR SMALL BORES



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BRYANT



Three Times More Engine Power

(Continued from page 39)

Lockheed, differing from the latter in the use of exhaust thrust from the rear of the engine nacelles.

The Lockheed installation included turbosuperchargers which gave the XP-49 a top speed of 458 mph and a ceiling of 37,500 ft, good performance for a 9½-ton combat plane. Development work on the I-1430 continued to improve its performance with an output of 2000 hp in 1944 and its present rating of 2100 hp at 3400 rpm at the critical altitude of the turbosupercharger. This represents an increase of 91 per cent in power output over the original model.

Lycoming

Lycoming Division of the Aviation Manufacturing Corp is an outgrowth of the Lycoming Manufacturing Co., builders of automotive and marine engines. The firm began the design of aircraft engines in 1928, and in 1934 was reorganized into its present corporate form. Lycoming produced a series of nine-cylinder radial air-cooled engines in the 225 to 265 hp class, and followed this with a series of four-cylinder horizontally-opposed light-plane engines in the 50 to 75 hp class.

Work on a high-horsepower, 24-cylinder "H," liquid-cooled, aircraft engine, designated the H-2470, started in July, 1939. The first test stand run was made in June, 1940, and the engine developed 1730 bhp. The following year this output had been increased to 2000 bhp. The Vultee XP-54 pusher pursuit plane had been designed around the new engine and the first test flight of the combination was made in November, 1942, at which time the H-2470 was developing 2300 hp at 3300 rpm at takeoff, an increase of 34 per cent in power output.

This engine was developed primarily by the Navy Department for use in aircraft and patrol-torpedo boats. The engine installed in the XP-54 was a Navy engine assigned to the Air Technical Service Command for the purpose. The Navy discontinued development of the H-2470 in April, 1943.

Design of the most powerful reciprocating aircraft engine yet attempted was begun by Lycoming in July, 1943. This giant engine is a 36-cylinder radial, liquid-cooled design consisting of nine banks of four cylinders each. It has been designed to produce 5000 hp at 2600 rpm. At the date of writing the first test run of this engine, the R-7755, is still pending. No details of the airplane to be used for its flight tests are releasable at this time.

Menasco

The Menasco Manufacturing Co., Los Angeles, Calif., was formed in 1926 and engaged initially in the con-

version of a quantity of surplus Salmson water-cooled engines into air-cooled types. In 1930 Menasco began the design and manufacture of a highly successful series of four- and six-cylinder in-line, aircooled, aircraft engines which were particularly noteworthy for their use in various special racing planes flown in the National Air Races through the Thirties.

During the war Menasco undertook the development of high-horsepower aircraft engines under Navy Department contract. The V-2040, a 12-cylinder, aircooled "V," designed to produce 2000 hp was developed. This was dropped prior to block testing in favor of a more promising design, the H-4070, a 24-cylinder, aircooled "H," designed to produce 3400 hp, stemming from the V-2040, with enlarged cylinder bore. The development of both of these engines was discontinued prior to completion.

Packard

The Packard Motor Car Co., Detroit, Mich., entered the aircraft engine field with the design of the famed Liberty engine during World War I. Following the Armistice Packard continued the development of high-power water-cooled aircraft engines for the Army and Navy and produced considerable quantities of the 3A-1500 and 3A-2500 12-cylinder "V" types which saw service in pursuit, bomber, fighter, torpedo, scout and other types of combat craft. An outstanding engineering job was done in creating the Packard Diesel aircooled radial aircraft engine in 1928.

In September, 1940, the Packard company contracted the quantity production of the British-designed Rolls-Royce Merlin 12-cylinder liquid-cooled "V" aircraft engine. The first two engines were given their test run in a special ceremony at Detroit on Aug. 2, 1941. This engine, the V-1650, developed 1385 bhp at 3000 rpm during the run. The first test flight of the Packard-built Merlin was made in March, 1942, installed in a Curtiss XP-40F pursuit plane. This installation proved so successful that production of the P-40F model was ordered as well as installation of the Merlin in the North American P-51B Mustang. These installations developed 1760 hp at 3000 rpm at 9250 ft. By 1944 the Packard Merlin was producing 1905 hp at 3000 rpm at 3100 ft and on V-J Day the engine was developing a maximum of 2500 hp, an increase of 81 per cent over the original model.

Pratt & Whitney

Pratt & Whitney Aircraft Division, United Aircraft Corp., East Hartford, Conn., shares with Wright the unex-

celled world-wide reputation for the design and manufacture of aircooled radial engines. The firm was founded in 1925 by Fred Rentschler and George J. Mead for the production of the Wasp nine-cylinder radial, aircooled aircraft engine, which has achieved a reputation unsurpassed by any other aircraft engine in the world. P & W began the development of twin row aircraft engines in 1929 which culminated in production of the R-1830 Twin Wasp engine in 1933. On its block test the R-1830 developed 830 bhp at 2400 rpm. Continued development and production of this engine produced an output of 1200 hp at 2700 rpm for takeoff at the time of Pearl Harbor. It saw service throughout the war installed in such combat planes as the Consolidated B-24 Liberator, Consolidated PB2Y Coronado, Grumman F4F Wildcat, the Douglas C-47 Skytrain transport and many others. Continued development increased its output at the close of the war to 1350 hp at 2800 rpm for takeoff, an increase of 63 per cent.

A special version of the Twin Wasp was developed for use in the giant Douglas C-54 Skymaster, hundreds of which saw service with the Air Transport Command and the Naval Air Transport Service. Due to the power requirements of the C-54 the R-1830 proved insufficient and the considerably larger R-2800 excessive. P & W increased the bore of the Twin Wasp from 5½ in. to 5¾ in. which resulted in the R-2000 engine that developed 1100 bhp on its first run, but which was improved to an output of 1450 hp at 2700 rpm at the close of the war, an increase of 32 per cent in power.

The R-2800 Double Wasp consists, essentially, of 18 Twin Wasp barrels mounted on a new crankcase with increased stroke. Design of this engine began in 1936 and the completed engine was displayed at the New York World's Fair in 1939. Its first block test in that year produced 1600 bhp. The following year this had been increased to 1850 bhp. First flight test was made in the Vought XF4U-1 Navy fighter in May, 1940. Development and production continued and the R-2800 saw war service in all combat theaters in such planes as the Martin B-26 Marauder, Grumman F6F Hellcat, Republic P-47 Thunderbolt, Northrop P-61 Black Widow and many others. On V-J Day the R-2800 was developing 3000 hp, an increase of 88 per cent over its original output.

Largest and most powerful radial air-cooled engine now in production is the P & W R-4360 Wasp Major, a 28-cylinder design consisting of four banks of seven cylinders each (see Sept. 15, 1946 issue of AUTOMOTIVE AND AVIATION INDUSTRIES, page 42). This giant
(Turn to page 64, please)



IT TAKES TWO TO SAVE FREE ENTERPRISE

Free enterprise and not-so-free enterprise are fighting it out for the world's markets. Both sides are turning out good products and doing all in their power to tempt the world buyer. We are at a disadvantage in one respect — we don't sacrifice human standards to cut costs

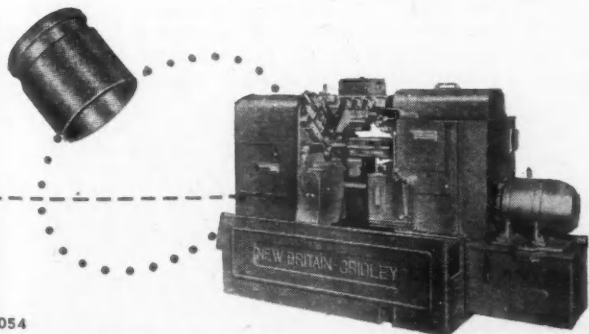
and lower prices. We must find some other way or lose the business.

The only other way is the way that leads to both lower costs and *higher* human living standards. It is a matter of lowering costs through more efficient production. In other

words, it's up to industry to provide the American worker with the world's best machines and the world's best methods. It's up to the man at the machine to make full use of the production the maker built into that machine. Below is an example of how one manufacturer is doing this.

EXAMPLE: Not all the worthwhile examples of good machining are tricky or "difficult" parts, by any means. Illustrated is a small piston, involving nine operations, including a rotating pick-off

spindle. On this job, 835 pieces are turned out per hour on the average, reducing cost per piece to an almost negligible factor in relation to the finished product in which it is employed.



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engine was undertaken in 1940 and its first test stand run was made in 1942 when it produced 3000 bhp, the first of its type to do so. Development continued until it is now producing 3500 bhp, an increase of 17 per cent in the brief period of four years. The R-4360 is still undergoing intensive development and is installed in such new craft as the Northrop XB-35 Flying Wing, the Consolidated Vultee XB-36 bomber, the Hughes Hercules, the Boeing Stratocruiser, the Republic Rainbow, the Boeing XB-44 Superfortress, the Hughes XF-11 photo plane, the Boeing XF8B-1 Navy fighters and many others. Confident predictions of output

as high as 4000 bhp have been made for the R-4360 in the immediate future.

An experimental 16-cylinder liquid-cooled design, the H-2600, was undertaken by P & W during the war. The design consisted of four banks of four cylinders each and was designed to produce 1700 bhp. However, its development was dropped in 1942.

Wright

Wright Aeronautical Corp., a division of the Curtiss-Wright Corp., is the world's oldest producer of aircraft engines, the present firm being a lineal descendant from the original Wright

Brothers bicycle shop in Dayton, Ohio at the turn of the century. It was the only aircraft engine firm to survive the crisis following World War I. The designs and types it has produced during the past 40 years are legion and include the famed Whirlwind and Cyclone radial air-cooled types which found world favor.

Design of the R-1820 Cyclone, the first air-cooled radial in the world to produce 1000 bhp, a long-time goal of the aircraft engine industry, was undertaken in 1924 and the first block test was made in 1927 at which time the engine produced 525 bhp. Research and development has been continuous over the past two decades and the R-1820 saw war service in all theaters in the Douglas DC-3 transport versions, the Eastern Aircraft FM fighters and many others. At the end of the war the Cyclone had a maximum output of 1600 hp, an increase of 262 per cent over its original power, truly an astonishing performance.

Development of a high-power radial liquid-cooled design, the R-2160, was undertaken during the war. This engine contains 42 cylinders arranged in six banks of seven cylinders each. It is designed to produce 2500 bhp but has not been type tested at this writing.

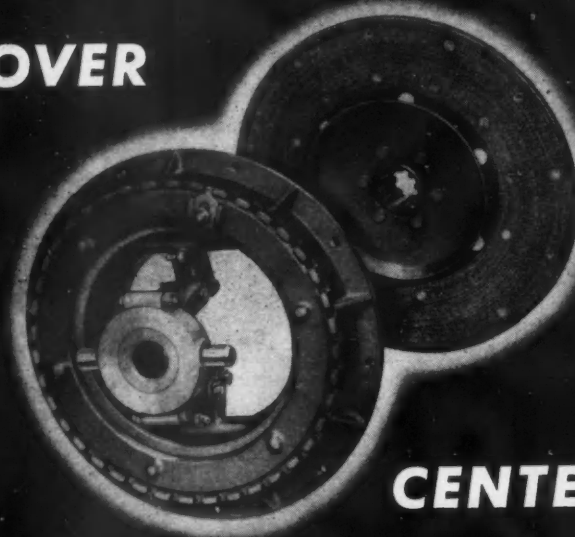
The Wright R-2600 Cyclone is a 14-cylinder radial air-cooled design which was started in 1935. Its first test stand run was made in 1937 at which time it developed 1500 bhp at 2300 rpm. Its first flight test was made in November, 1938 in a Douglas XB-23 twin-engine bomber. Development work continued with 1600 hp being available in 1939 and 1700 hp at the time of Pearl Harbor. The R-2600 saw wartime service aboard such famed planes as the North American B-25 Mitchell, the Douglas A-20 Havoc, Grumman TBF Avenger, Curtiss SB2C Helldiver, Martin PBM Mariner and others. At the close of the war the R-2600 had an output of 1900 hp, an increase of 27 per cent over its original power.

Engineering on the Wright R-3350 began in 1935. It is fundamentally two seven-cylinder Cyclone engines mounted axially on a common crankcase. Its first block test was made in 1938 at which time it developed 1800 bhp. Its first aircraft installation was in the giant Martin PB2M-1 Mars flying boat which flew for the first time in November, 1941. The R-3350 is best known as the powerplant for the Boeing B-29 Superfortress. Development of the type continued throughout the war and V-J Day found it producing a total of 3400 bhp, an increase of 89 per cent over its original output.

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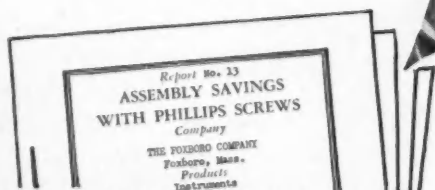
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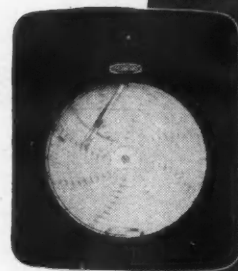
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Pressure Duration Indicator

(Continued from page 24)

with very little loss to, and emitted from, its other end. Whenever the rotor rotates the peripheral end of the light conductor arm describes a circle in a plane perpendicular to the axis of rotation.

The housing of the rotor carries a graduated protractor dial, and it also supports the signal lamps at the center of the rotor, facing the central end of the light conductor arm.

Whenever the rotor is rotated by the engine, and the neon lamp illuminates the central end of the light conductor arm during part of the revolution, the peripheral end of the light-conductor arm will describe a lighted arc. The phase of its beginning and of its end can be read on the protractor dial. The dial is adjustable angularly and can be locked in any position. In the initial setting, the engine is brought to the dead center phase, and the zero mark on the protractor is brought into coincidence with the outer end of the light conductor arm.

In order to visualize the operation of this device let us assume that the engine is running at low load (Fig. 2) and that the balancing pressure is adjusted to a low value at or near atmospheric pressure. Then the diaphragm of the pickup will make contact with the insulated electrode during most of the compression and expansion stroke of the engine cycle; hence the lighted arc described by the peripheral end of the light-conductor arm will extend around a large portion of the periphery. If then, by admitting pressure gas to the manifold, the balancing pressure is increased the lighted arc will diminish in length, until finally, at a balancing pressure of 700 psi, which is the maximum pressure in our example, only a flicker will show at a few degrees after dead center. Thus the complete diagram of the engine pressure can be obtained by taking a set of data, noting the balancing pressure and the corresponding phases of the beginning and end of lighted arc, increasing the balancing pressure in steps, and then plotting the pressure as a function of phase of rotation. Or, let us consider another imaginary experiment. Let the balancing pressure be set at 500 psi (Fig. 2) and the engine running at light load, with a maximum pressure of 700 psi. The lighted arc on the screen will extend from about four deg BDC to 26 deg ADC, a total duration of 30 deg. Then, keeping the balancing pressure the same, 500 psi, let the engine load be increased. The picture on the screen will change: the beginning of the lighted arc will remain at the same phase, four deg BDC, but the end will be extended to about 40 deg ADC, a total duration of 44 deg. Thus the length of the lighted arc—the balancing pressure being kept constant—is a measure

of the loading of the engine.

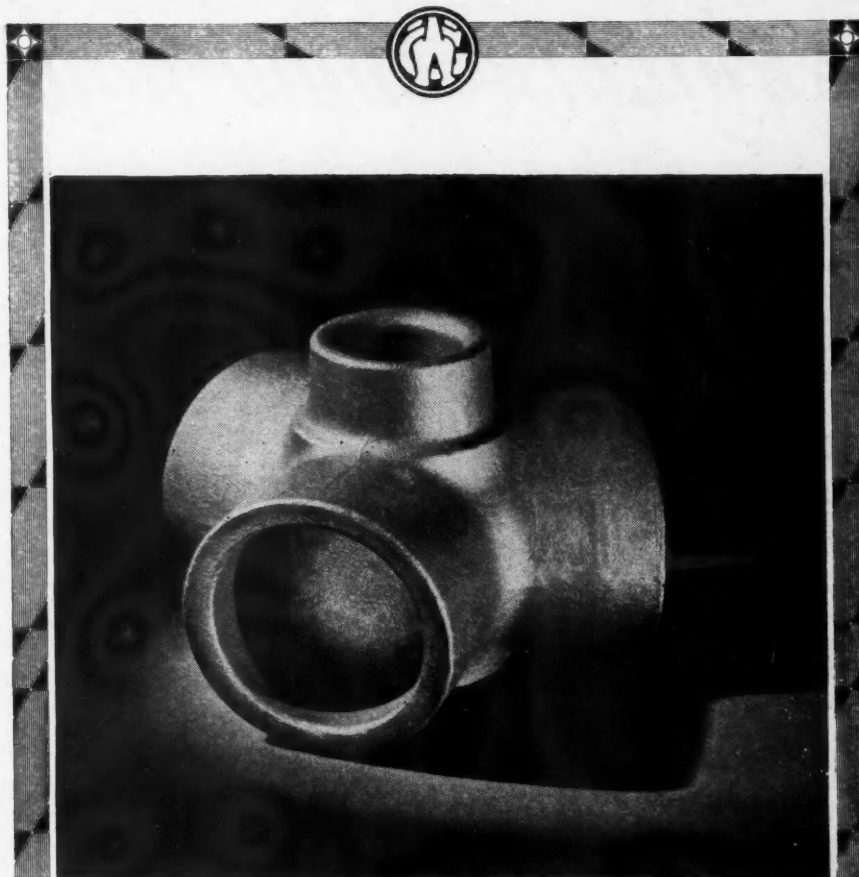
Investigation of Valve-Lift Events

The described neon lamp and phase indicating device can be controlled by some other periodic event of the engine instead of the pressure cycle, by incorporating in the electric circuit a contactor responsive to the periodic event to be investigated. Such periodic events which may be of interest for supervising the operation of the engine, are for example, the occurrence of dead center

of a crank, and the opening and closing of the intake, exhaust and injector valves.

In Fig. 1 is illustrated schematically a Dead Center Contactor, which is a stationary metal finger not in contact with the flywheel itself but which makes a contact with a raised cam surface formed on the periphery of the flywheel, and situated symmetrically relative to the crank radius. By means of a circuit switch this dead center contactor can be switched into the neon lamp circuit. It can be visualized that in this case the mid point of the lighted arc will define the dead center phase. Then, by alternately switching into the

(Turn to page 68, please)



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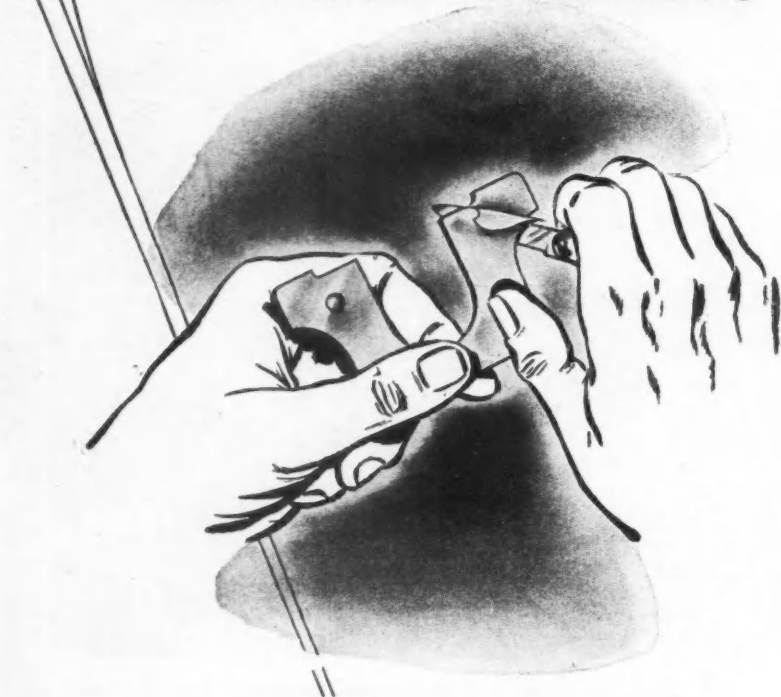
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electric circuit either the pressure pickup, or the dead center contactor, the phase disposition of the pressure indication with reference to the dead center phase can be determined. This method of dead center determination eliminates the error, slight though it is, due to the delay of response of the neon lamp, and hence it is more accurate than relying on the initial setting of the sweep dial as described previously.

In Fig. 1 there is illustrated also another contactor, controlled by the needle valve of the injection nozzle, which can be switched into the neon lamp circuit by means of another circuit switch. It can be visualized that under the control of this contactor the lighted arc will indicate the phase and duration of injection.

It is only a matter of skill to devise other types of contactors adapted to be actuated by any other periodic engine event which may be of interest for some particular investigation.

Application to Multi-Cylinder Engines

In the case of a multi-cylindered engine each engine cylinder is fitted with a pressure pickup, all of which are subjected to the same balancing pressure. The cylinders may be fitted also with other contactors such as those actuated by the injection nozzles. Each of these contactors can be switched into and out of the neon lamp circuit by the aid of a circuit switch. Then by switching in the pressure pickups one, by one, the duration, while the engine pressure surpasses the set balancing pressure, can be observed on the screen in rapid succession for each cylinder. By increasing the balancing pressure a new reading can be taken; longer arcs will correspond to higher loading. Then, by switching into the circuit the contactors actuated by the injector valves, it can be determined whether or not any existing fault is caused by uneven timing or uneven duration of the injections.

The several contactors responsive to several periodic events can be switched into the circuit not only successively but even **simultaneously**, provided the durations of the periodic events do not overlap. Thus, the peak portions of the pressure cycles of a multi-cylinder engine can be examined simultaneously provided the duration of the pressure is short enough for the several lighted arcs not to merge together. Fig. 3 illustrates the appearance of the dial in the case of a six-cylinder four stroke engine operated at uneven load distribution, the cylinders working at low, medium, and high loading. Increasing the balancing pressure will reduce the length of the lighted arcs, until one by one they will disappear, as the maximum pressure in each cylinder is reached.

(Part II will follow in an early issue of AUTOMOTIVE and AVIATION INDUSTRIES.)